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Thermal and epithermal flux shapes in the thermal column of the UTR-10 reactor

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THERMAL AND EPITHERMAL FLUX SHAPES IN THE THERMAL COLUMN OF THE UTR-10 REACTOR 83

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INTRODUCTION

To the prospective user of a reactor as a tool for research, knowledge of the thermal and total neutron fluxes in it is necessary.

This study aims partly to supply this knowledge, for a definite plane in the thermal column of the UTR-10 reactor of the Iowa State University.

The thermal column was chosen for this study because it is most frequently used as the source of slow neutrons, since slow neutrons show more marked and interesting effects on their interactions with nuclei than fast neutrons. Accordingly a great portion of practical research with neutrons, involving the use of nuclear reactors for their production, require slow neutrons.

Reactor design is commonly based on the assumption of only two groups of neutrons: fast and slow (or thermal). Nowak and Chow's analysis of the UTR-10 (5) is also on the same basis: a two-group diffusion theory. Their calculations were carried out on the IBM 650 making use of the data and results accumulated from experience on the MTR and the Argonaut II. Their results, given in Figures 32-37 in the report above cited, have been used as a check on the results of the present work.

THE THERMAL COLUMN

One of the experimental facilities of the UTR-10 reactor is the graphite thermal column. It is 4 ft by 5 ft by 5 ft long, and contains 15 stringers each 4 inches square. A $1\frac{1}{2}$-inch thick lead gamma curtain is incorporated between the core and the thermal column. The fifteen stringers are symmetrically located within the column; the longest one, the center stringer, has access through the lead gamma curtain and the core reflector to within 4 3/4 inches from the outer wall core of the south core tank.

The plan and elevation of the thermal column are shown in Figure 1, while Figure 2 shows the detail of one of the stringers. Each stringer contains small cavities, equally spaced, in which foils may be placed for activation.

The third row of stringers from the top contains five stringers, so located that their upper faces are nearly in the median plane of the thermal column. It is along this plane that the fluxes have been measured. Thus, five points are available for each transverse plane.

The central stringer extends beyond the gamma shield but the other four do not, so only those positions along the stringers were chosen that lie outside the gamma shield. Positions located at every other hole were taken, with the distances indicated in Figure 2.

For the present explanation, the positions along the stringers will be designated by the consecutive numbers 1, 2, ... 6 from the outermost point inward, and the stringers will be designated as A, B, C, D, E, from left to right facing the thermal column.

FOILS AND CADMIUM COVERS

The indium foils used were in the form of thin discs, $\frac{1}{4}$ inch in diameter and approximately 2 mils thick. The small area assured a reasonable count rate within a few hours after irradiation, while the small thickness diminished flux perturbation effects.

The gold foils used were also in the form of thin discs, $\frac{1}{2}$ inch in diameter and approximately 1 mil thick.

The cadmium covers used were of 30 mil thickness mentioned by Hughes (2, p.62) as the usual thickness used, and which is taken by Martin (3) as the limit of the straight line which represents the attenuation of epicadmium neutrons. Tittle had stated that 20 mil cadmium covers would absorb all of the thermal neutrons, but measurement of the cadmium correction factor showed that this thickness is not black to thermal neutrons, as found by Mills, (4, p.24).

The cadmium covers were made by punching circular discs from sheets of 30 mil thick cadmium and forming the discs into cups which fitted into each other.

PROCEDURE

For the first set of trials bare indium foils were placed at the chosen positions -- 30 in all -- then the reactor was brought to the desired power level (600 watts), and the foils irradiated for the indicated number of minutes (usually 20, in two cases 10 minutes), after which time the reactor was scrammed. When the radiation level reached a safe value, the foils were removed from the stringer positions and their activities measured successively on a gas flow counter, starting with the outermost foils which were expected to be activated the least.

For each measurement, the time of start, the duration, the foil number and weight, and the total counts were recorded. Background measurements were taken at least twice during each series of counts.

For counter standardization a measurement was made of the radiation from a standard uranium source; and for power standardization an extra indium foil was placed for each trial at position 7 (Figure 2). Since the activity of this foil was usually observed much later than the others, through the same absorber (No. 13), another observation was taken of the uranium standard source before measuring the activity of the standardization foil.

Similar runs were made at power levels of 1200 watts and 1800 watts. The whole set of trials was repeated with cadmium-covered indium foils, and with bare and cadmium-covered gold foils.

COMPUTATIONS

The computations may be divided into two parts: the first part is the determination of the correct net counts per minute registered by each foil, and the second is the normalization of these net count rates and calculation of the saturated foil activity.

Part 1

The total counts registered on the counter, divided by the time of counting, gave the gross counts per minute.

Dead-time correction

The first correction applied to the gross counts per minute was the dead-time correction:

$$r_{corr} = \frac{r_{obs}}{1 - r_{obs}t_d}$$

where r_{corr} = rate corrected for dead time,

r_{obs} = observed rate,

and t_d = dead-time of the scaler.

Hence the correction

$$\Delta r = r_{corr} - r_{obs}$$

$$= \frac{r_{obs}}{1 - r_{obs}t_d} - r_{obs}$$

$$= \frac{r_{obs}^2 t_d}{1 - r_{obs}t_d} \approx r_{obs}^2 t_d$$

The manufacturer's specifications state that the dead-time correction of the scaler used is 1% for 100,000 counts per minute. Hence,

$0.01 \times 10^5 = (10^5)^2 \ t_d$, from which $t_d = \frac{10^3}{10^{10}} = 10^{-7}$ min.

The correction therefore is

$$\Delta r = (10^{-7}) \ r_{obs}^2$$

if r_{obs} is expressed as counts per minute.

For 100,000 counts per minute, $r_{obs}t_d = 10^5 \times 10^{-7} = 10^{-2}$, and the error introduced in neglecting this term in the denominator amounts to approximately 1%.

To miss a count of 0.5 per minute, the smallest that could affect the units' digit, $r_{obs}^2 = \frac{0.5}{10^{-7}} = 0.5 \times 10^7$ or $r_{obs} = \sqrt{0.5 \times 10^7} = 2.3 \times 10^3$ or 2,300 per minute. So the dead-time correction will affect the units' digit only for count rates greater than 2,300 per minute, and is therefore applied only for count rates exceeding this.

The dead-time correction is added to the gross counting rate.

Background correction

Next, the background count rate is subtracted from the sum of the gross counting rate and the dead-time correction, and the result is here called the net count rate.

The computations are shown in Tables 5 to 16.

Part 2

The second part of the computations is concerned with the normalization of the net count rate for foil weight, for absorber, for reactor power and counter variations, and for foil decay, and the calculation of the saturated foil activity.

Normalizing for foil weight

To correct for the variation in weights of foils, all net count rates were reduced to the basis of one milligram of foil weight.

Absorber factor

Due to the excessively high counts registered with some foils, it was necessary to use absorbers. First, absorber No. 12 was used, and when the counts reached about 75,000 per minute, also absorber No. 13.

The absorber factor was computed thus:

Let r = count rate (per minute) without absorber, (or with one absorber)

r' = count rate (per minute) with absorber (or with another absorber), taken t minutes later.

b = background count rate (per minute)

Then the absorber factor $= \dfrac{r - b}{\dfrac{r' - b}{e^{-\lambda t}}} = \dfrac{(r-b)e^{-\lambda t}}{r' - b}.$

The computation of the absorber factors is shown in Table 17.

The result of applying this correction is indicated in Tables 5 to 16 as the true net count rate.

Foil decay correction

Most of the foils were irradiated at a constant power for 20 minutes; because of the high count rates expected during the irradiations of bare indium foils at 1200 watts and 1800 watts, these were done for only 10 minutes. Although there was some variation in reactor power during start-up, which usually took from 2 to 5 minutes, and during shut-down, which was much shorter, lasting for a few seconds only, this variation was measured by the activation of the standardization foils in position 7, so no correction was applied for the time of start-up.

The foil decay is corrected for by the factor $e^{\lambda t_w}$ where t_w is the time of waiting, in minutes, and is taken from reactor scram time until the middle of the counting period.

To calculate the activity that the foil would have had if it had been irradiated to saturation and observed immediately upon removal from the flux, the correction factor $\dfrac{1}{1 - e^{-\lambda t_e}}$ was used, where t_e is the time of exposure, in minutes, of the foils to the flux.

Counter correction factor

To correct for possible variations in the counter performance, a reading was taken of the activity of the uranium standard before each set of counts. Run I was again chosen as the basis to which the other runs were normalized.

The correction for variation in counter efficiency for each run was obtained as the ratio of the activities of the uranium standard for that run to that of the uranium standard for Run I.

The calculations for the counter correction factor, F_c, are shown in Table 18.

Reactor power normalization

The power of Run I was chosen as the base level to which all other runs were normalized. The correction for variation in reactor power was made by relating the net corrected activities of the standardization foils of each run to that of the standardization foil of Run I.

The calculations of the reactor power correction factors, F_p, are shown in Tables 19a and 19b.

All these last four correction factors were grouped together and calculated as a single correction factor, F, given by

$$F = \frac{F_p\ F_c}{(1-e^{-\lambda t_e})e^{-\lambda t_w}} .$$

This composite correction factor was applied to the net count rates per milligram to give the normalized saturation activities for each foil.

Some correction factors neglected

The cadmium correction factor and the thermal depression factor were here neglected. The first depends on the thicknesses of cadmium and of indium (or gold) used, and since these are the same throughout the experiment the cadmium correction factor is constant. Neglecting it does not affect the relative values of the activities.

The flux depression factor is small and may be neglected for the thickness of cadmium used here. Moreover, the values of this correction factor (for 0.040 in. cadmium thickness) calculated by Martin (3) from the data presented by various researchers, show differences which are more than the estimated error, and "variations in foil thickness, foil area, or cadmium ratio, do not seem to account for this difference." Because of the uncertainity in determining its value, this correction factor has been neglected.

Cadmium ratio

The cadmium ratio at each of the points was calculated by dividing the saturation activity of the bare indium foil by that of the cadmium-covered foil.

Accuracy of results; significant figures

In most of the computations the weight of the foil, which is known to four-figure accuracy, controlled the number of significant figures in the result. However, for count rates less than a thousand per minute, it is this rate which governs. During the intermediate computations the results were carried to one figure more than the desired number, but the final results were written to agree with the least number of significant figures in the quantities that entered into the calculations.

Because of the time involved, only one count (of 2 minutes or longer) was made of each activity. Hence, according to statistics (Price, 6, pp. 58-59 and Friedlander and Kennedy, 1, pp. 258-259), the expected standard deviation in the count is its square root; i.e., if n is the number of counts in a time interval t, $r = \frac{n}{t}$ and $\sigma_r = \frac{\sqrt{n}}{t}$. With the additional computations involved in the different corrections applied, (for dead time, for background, for foil weight, for absorber factors, etc.), the standard deviation is increased. The resultant over-all standard deviation is of the order of 1% or less for count rates over 10,000 per minute, about 1-3% for rates between 1,000 and 10,000 per minute. The percentage error for count rates below 1,000 per minute is greater, about 5%. Count rates below 10 per minute are very much in error and are disregarded. The low count rates (below 100) are included to complete the data, but they are to be regarded as inaccurate, and this is so indicated in the graphs.

Analytical (theoretical) curves

Figures 32-37 of the report of Nowak and Chow (5) give the results of their theoretical calculations, their analysis being based on two-group diffusion theory for the three regions of the reactor: the central thermal column, the fuel tank and the external reflector. Their figure 33 gives the fast and thermal flux distribution in a 5 ft by 5 ft by 6 ft long external thermal column; these dimensions are the closest to the actual dimensions of the thermal column used in the experiment.

The calculation of the theoretical fluxes is shown in Tables 3, 4a and 4b. Values of the fast and thermal fluxes at the proper distances from the fuel slab were read from the graph. Since these were for an infinite medium, they would correspond only to the central stringer (c) of the thermal column and since they were the expected fluxes when the reactor is operating at 10 kw, the corresponding flux level were computed proportionally for 600, 1200 and 1800 watts.

To correlate these fluxes with the activities obtained in the experiment, the maximum flux was taken to correspond to the highest activity (at the point 6, closest to the core), and the fluxes corresponding to the other points were obtained by proportion. These activities, fitted to the corresponding theoretical fluxes, are shown with the experimental curves for stringer c, in Figures 5 and 10.

RESULTS

The calculated saturation activities for bare and cadmium covered indium foils, as well as the cadmium ratios, are shown in tabular form for each of the stringers A to E (Table 1a), and for each of the transverse planes along points 1 to 6 (Table 1b). These are also displayed in graphical form, Figures 3 to 12 for the stringers A to E, and Figures 23 to 34 for the transverse planes 1 to 6.

A similar set of experiments was done with both bare and cadmium-covered gold foils. The results are given in Tables 2a and 2b, and shown in Figures 13 to 22 for stringers A to E, and in Figures 35 to 46 for transverse planes 1 to 6. However, the cadmium ratios are not shown here, since the quotient of the activities of the bare and cadmium-covered foils is <u>not</u> the cadmium ratio.

Table 1a. Saturation activities of bare and cadmium-covered indium foils at planes along the stringers on the median plane of the thermal column

Position	At 600 watts			At 1200 watts			At 1800 watts		
	Bare	Cadmium covered	Cadmium ratio	Bare	Cadmium covered	Cadmium ratio	Bare	Cadmium covered	Cadmium ratio
Stringer A:									
1	1.041×10^{5}	14.3	7,290	2.119×10^{5}	32.4	6,550	3.208×10^{5}	50.3	6,370
2	2.957×10^{5}	70.3	4,210	5.772×10^{5}	140	4,130	8.722×10^{5}	407	2,140
3	6.366×10^{5}	354	1,800	1.280×10^{6}	697	1,840	1.882×10^{6}	1,047	1,800
4	1.347×10^{6}	2,317	581.8	2.684×10^{6}	4,444	604.0	3.980×10^{6}	6,672	596.6
5	2.669×10^{6}	17,040	156.7	5.387×10^{6}	30,510	176.6	8.074×10^{6}	47,860	168.7
6	5.567×10^{6}	117,900	47.20	1.143×10^{7}	245,600	46.56	1.698×10^{7}	349,700	48.55
Stringer B:									
1	1.236×10^{5}	15.7	7,870	2.461×10^{5}	61.1	4,030	3.707×10^{5}	89.5	4,140
2	3.446×10^{5}	87.2	3,950	6.699×10^{5}	169	3,970	1.027×10^{6}	279	3,680
3	7.370×10^{5}	477	1,540	1.493×10^{6}	883	1,690	2.232×10^{6}	1,295	1,720
4	1.603×10^{6}	3,060	523.9	3.162×10^{6}	6,096	518.7	4.775×10^{6}	8,913	535.7
5	3.360×10^{6}	24,490	137.2	6.833×10^{6}	46,860	145.8	1.005×10^{7}	69,980	143.6
6	7.156×10^{6}	184,700	38.74	1.434×10^{7}	367,700	38.99	2.078×10^{7}	529,800	39.22
Stringer C:									
1	1.281×10^{5}	20.9	6,120	2.538×10^{5}	35.3	7,190	3.774×10^{5}	58.8	6,420
2	3.461×10^{5}	96.0	3,610	6.988×10^{5}	609	1,150	1.033×10^{6}	307	3,370
3	7.564×10^{5}	444	1,710	1.541×10^{6}	992	1,550	2.313×10^{6}	1,390	1,660
4	1.627×10^{6}	2,930	555.4	3.289×10^{6}	6,277	523.9	4.843×10^{6}	9,172	528.0
5	3.452×10^{6}	24,920	138.6	6.950×10^{6}	49,650	140.1	1.027×10^{7}	72,690	141.3
6	7.228×10^{6}	190,000	38.04	1.483×10^{7}	394,000	37.65	2.080×10^{7}	521,100	39.91
Stringer D:									
1	1.232×10^{5}	20.6	5,970	2.330×10^{5}	65.0	3,580	3.671×10^{5}	160	2,300
2	3.317×10^{5}	74.2	4,470	6.402×10^{5}	159	4,030	9.862×10^{5}	237	4,160
3	7.646×10^{5}	451	1,700	1.485×10^{6}	839	1,770	2.190×10^{6}	1,226	1,790
4	1.539×10^{6}	3,213	479.0	3.170×10^{6}	6,394	494.6	4.689×10^{6}	10,290	455.6
5	3.080×10^{6}	24,060	128.0	6.629×10^{6}	43,900	151.0	2.873×10^{6}	65,930	149.8
6	6.846×10^{6}	173,300	39.50	1.362×10^{7}	341,800	39.85	2.067×10^{7}	499,400	41.39
Stringer E:									
1	1.020×10^{5}	17.8	5,730	2.091×10^{5}	105	1,990	3.015×10^{5}	142	2,120
2	2.763×10^{5}	72.8	3,790	5.615×10^{5}	122	4,580	8.550×10^{5}	270	3,160
3	6.031×10^{5}	313	1,930	1.263×10^{6}	744	1,700	1.889×10^{6}	967	1,950
4	1.286×10^{6}	2,009	639.8	2.607×10^{6}	4,122	632.6	3.849×10^{6}	5,923	649.9
5	2.679×10^{6}	15,060	177.8	5.326×10^{6}	36,790	144.8	7.967×10^{6}	45,340	175.7
6	5.465×10^{6}	109,000	50.14	1.087×10^{7}	225,700	48.14	1.634×10^{7}	322,400	50.70

Table 1b. Saturation activities of bare and cadmium-covered gold foils at planes along the stringers on the median plane of the thermal column

Position	At 600 watts			At 1200 watts			At 1800 watts		
	Bare	Cadmium covered	Cadmium ratio	Bare	Cadmium covered	Cadmium ratio	Bare	Cadmium covered	Cadmium ratio
Stringer A:									
1	3.430×10^4	-		6.851×10^4	14		1.075×10^5	34	
2	9.503×10^4	300		1.878×10^5	45		2.889×10^5	48	
3	2.073×10^5	477		4.150×10^5	287		6.456×10^5	300	
4	4.353×10^5	1,040		8.613×10^5	992		1.317×10^6	2,200	
5	8.935×10^5	5,436		1.773×10^6	11,460		2.711×10^6	15,740	
6	1.817×10^6	38,430		3.647×10^6	81,730		5.569×10^6	119,500	
Stringer B:									
1	4.147×10^4	-		8.241×10^4	42		1.259×10^5	19	
2	1.127×10^5	370		2.231×10^5	71		3.456×10^5	4	
3	2.454×10^5	650		4.936×10^5	312		7.675×10^5	424	
4	5.175×10^5	1,460		1.034×10^6	2,108		1.585×10^6	2,940	
5	1.102×10^6	8,730		2.194×10^6	15,820		3.374×10^6	23,330	
6	2.322×10^6	61,950		4.672×10^6	126,320		7.069×10^6	182,500	
Stringer C:									
1	4.296×10^4	360		8.348×10^4	19		1.325×10^5	79	
2	1.166×10^5	470		2.244×10^5	127		3.547×10^5	66	
3	2.558×10^5	500		4.952×10^5	356		7.761×10^5	472	
4	5.316×10^5	1,520		1.033×10^6	2,110		1.627×10^6	2,920	
5	1.115×10^6	8,502		2.217×10^6	18,010		3.446×10^6	24,610	
6	2.407×10^6	62,340		4.703×10^6	142,500		7.348×10^6	202,800	
Stringer D:									
1	4.072×10^4	230		5.296×10^4	19		1.243×10^5	7	
2	1.121×10^5	470		2.258×10^5	73		3.394×10^5	58	
3	2.480×10^5	700		4.869×10^5	296		7.471×10^5	404	
4	5.228×10^5	1,270		1.043×10^6	2,128		1.589×10^6	2,900	
5	1.093×10^6	8,250		2.181×10^6	16,020		3.406×10^6	23,530	
6	2.315×10^6	59,970		4.620×10^6	127,400		7.032×10^6	187,200	
Stringer E:									
1	3.448×10^4	71		6.938×10^4	20		1.100×10^5	19	
2	9.524×10^4	320		1.938×10^5	38		2.903×10^5	82	
3	2.113×10^5	580		4.151×10^5	220		6.384×10^5	331	
4	4.350×10^5	1,050		8.684×10^5	1,400		1.281×10^6	2,110	
5	8.916×10^5	5,537		1.805×10^6	11,290		2.672×10^6	15,260	
6	1.828×10^6	36,570		3.662×10^6	79,580		5.349×10^6	114,700	

Table 2a. Saturation activities of bare and cadmium-covered indium foils at planes across the central stringer on the thermal column

Stringer	At 600 watts Bare	Cadmium covered	Cadmium ratio	At 1200 watts Bare	Cadmium covered	Cadmium ratio	At 1800 watts Bare	Cadmium covered	Cadmium ratio
Plane 1:									
A	1.041×10^{5}	14.3		2.119×10^{5}	32.4		3.208×10^{5}	50.3	
B	1.236×10^{5}	15.7		2.461×10^{5}	61.1		3.707×10^{5}	89.5	
C	1.281×10^{5}	20.9		2.538×10^{5}	35.3		3.774×10^{5}	58.8	
D	1.232×10^{5}	20.6		2.330×10^{5}	65.0		3.671×10^{5}	160	
E	1.020×10^{5}	17.8		2.091×10^{5}	105		3.015×10^{5}	142	
Plane 2:									
A	2.957×10^{5}	70.3		5.772×10^{5}	140		8.722×10^{5}	407	
B	3.446×10^{5}	87.2		6.699×10^{5}	169		1.026×10^{6}	279	
C	3.461×10^{5}	96.0		6.988×10^{5}	609		1.033×10^{6}	307	
D	3.317×10^{5}	74.2		6.402×10^{5}	159		9.862×10^{5}	237	
E	2.763×10^{5}	72.8		5.615×10^{5}	122		8.550×10^{5}	270	
Plane 3:									
A	6.366×10^{5}	354		1.280×10^{6}	697		1.882×10^{6}	1,047	
B	7.370×10^{5}	477		1.493×10^{6}	883		2.232×10^{6}	1,295	
C	7.564×10^{5}	444		1.541×10^{6}	992		2.313×10^{6}	1,390	
D	7.646×10^{5}	451		1.485×10^{6}	839		2.190×10^{6}	1,226	
E	6.031×10^{5}	313		1.263×10^{6}	744		1.889×10^{6}	967	
Plane 4:									
A	1.347×10^{6}	2,317		2.684×10^{6}	4,444		3.980×10^{6}	6,672	
B	1.603×10^{6}	3,060		3.162×10^{6}	6,096		4.775×10^{6}	8,913	
C	1.627×10^{6}	2,930		3.289×10^{6}	6,277		4.843×10^{6}	9,172	
D	1.539×10^{6}	3,213		3.170×10^{6}	6,394		4.699×10^{6}	10,290	
E	1.286×10^{6}	2,900		2.607×10^{6}	4,122		3.849×10^{6}	5,923	
Plane 5:									
A	2.669×10^{6}	17,040		5.387×10^{6}	30,510		8.074×10^{6}	47,860	
B	3.360×10^{6}	24,490		6.833×10^{6}	46,860		1.005×10^{7}	69,980	
C	3.452×10^{6}	24,920		6.950×10^{6}	49,630		1.027×10^{7}	72,690	
D	3.080×10^{6}	24,060		6.629×10^{6}	43,900		9.873×10^{6}	65,930	
E	2.679×10^{6}	15,060		5.326×10^{6}	36,790		7.967×10^{6}	45,340	
Plane 6:									
A	5.567×10^{6}	1.179×10^{5}		1.143×10^{7}	2.456×10^{5}		1.698×10^{7}	3.497×10^{5}	
B	7.156×10^{6}	1.847×10^{5}		1.434×10^{7}	3.677×10^{5}		2.078×10^{7}	5.298×10^{5}	
C	7.228×10^{6}	1.900×10^{5}		1.483×10^{7}	3.940×10^{5}		2.080×10^{7}	5.211×10^{5}	
D	6.846×10^{6}	1.733×10^{5}		1.362×10^{7}	3.418×10^{5}		2.067×10^{7}	4.994×10^{5}	
E	5.465×10^{6}	1.090×10^{5}		1.087×10^{7}	2.257×10^{5}		1.634×10^{7}	3.224×10^{5}	

Table 2b. Saturation activities of bare and cadmium-covered gold foils at planes across the central stringers on the thermal column

Stringer	At 600 watts			At 1200 watts			At 1800 watts		
	Bare	Cadmium covered	Cadmium ratio	Bare	Cadmium covered	Cadmium ratio	Bare	Cadmium covered	Cadmium ratio
Plane 1:									
A	3.430×10^4	-		6.851×10^4	14		1.075×10^5	34	
B	4.147×10^4	-		8.241×10^4	42		1.259×10^5	19	
C	4.296×10^4	360		8.348×10^4	19		1.325×10^5	79	
D	4.072×10^4	230		5.296×10^4	19		1.243×10^5	7	
E	3.448×10^4	71		6.938×10^4	20		1.100×10^5	19	
Plane 2:									
A	9.503×10^4	300		1.878×10^5	45		2.889×10^5	48	
B	1.127×10^5	370		2.231×10^5	71		3.456×10^5	4	
C	1.166×10^5	470		2.244×10^5	127		3.547×10^5	66	
D	1.121×10^5	470		2.258×10^5	73		3.394×10^5	58	
E	9.524×10^4	320		1.938×10^5	38		2.903×10^5	82	
Plane 3:									
A	2.073×10^5	477		4.150×10^5	287		6.456×10^5	300	
B	2.454×10^5	650		4.936×10^5	312		7.675×10^5	424	
C	2.558×10^5	500		4.952×10^5	356		7.761×10^5	472	
D	2.480×10^5	700		4.869×10^5	296		7.471×10^5	404	
E	2.113×10^5	580		4.151×10^5	220		6.384×10^5	331	
Plane 4:									
A	4.353×10^5	1,040		8.613×10^5	992		1.317×10^6	2,200	
B	5.175×10^5	1,460		1.034×10^6	2,108		1.585×10^6	2,940	
C	5.316×10^5	1,520		1.033×10^6	2,110		1.627×10^6	2,920	
D	5.228×10^5	1,270		1.043×10^6	2,128		1.589×10^6	2,900	
E	4.350×10^5	1,050		8.684×10^5	1,400		1.281×10^6	2,110	
Plane 5:									
A	8.935×10^5	5,436		1.773×10^6	11,460		2.711×10^6	15,740	
B	1.102×10^6	8,730		2.194×10^6	15,820		3.374×10^6	23,300	
C	1.115×10^6	8,502		2.217×10^6	18,010		3.446×10^6	24,610	
D	1.093×10^6	8,250		2.181×10^6	16,020		3.406×10^6	23,530	
E	8.916×10^5	5,537		1.805×10^6	11,290		2.672×10^6	15,260	
Plane 6:									
A	1.817×10^6	38,430		3.647×10^6	81,730		5.569×10^6	119,500	
B	2.322×10^6	61,950		4.672×10^6	126,300		7.069×10^6	182,500	
C	2.407×10^6	62,340		4.703×10^6	142,500		7.348×10^6	202,800	
D	2.315×10^6	59,970		4.620×10^6	127,400		7.032×10^6	187,200	
E	1.828×10^6	36,570		3.662×10^6	79,580		5.349×10^6	114,700	

Table 3. Thermal flux

	At 100 kw From Fig 33	At 600 w	At 1200 w	At 1800 w
1	5.7×10^{8}	3.42×10^{6}	6.84×10^{6}	1.026×10^{7}
2	1.88×10^{9}	1.128×10^{7}	2.256×10^{7}	3.384×10^{7}
3	4.2×10^{9}	2.52×10^{7}	5.04×10^{7}	7.56×10^{7}
4	8.6×10^{9}	5.16×10^{7}	1.032×10^{8}	1.548×10^{8}
5	1.78×10^{10}	1.068×10^{8}	2.136×10^{8}	3.204×10^{8}
6	3.6×10^{10}	2.16×10^{8}	4.32×10^{8}	6.48×10^{8}

Table 4a. Fast flux and theoretical foil activities

	At 10 kw From Fig 33	Fast Flux At 600 w	Fast Flux At 1200 w	Fast Flux At 1800 w	Foil Activities At 600 w	Foil Activities At 1200 w	Foil Activities At 1800 w
1	3.0×10^{6}[a]	1.80×10^{4}	3.60×10^{4}	5.40×10^{4}	230	480	640
2	1.35×10^{7}	8.10×10^{4}	1.62×10^{5}	2.43×10^{5}	1,050	2,170	2,870
3	5.2×10^{7}	3.12×10^{5}	6.24×10^{5}	9.36×10^{5}	4,040	8,360	11,000
4	1.88×10^{8}	1.13×10^{6}	2.26×10^{6}	3.39×10^{6}	14,600	30,300	40,000
5	6.8×10^{8}	4.08×10^{6}	8.16×10^{6}	1.224×10^{7}	52,700	109,000	145,000
6	2.45×10^{9}	1.47×10^{7}	2.94×10^{7}	4.41×10^{7}	190,000	394,000	521,100

[a] From Fig 37, Nowak and Chow (5).

Table 4b. Total flux and theoretical foil activities

	Total Flux				Foil Activities		
	At 10 kw	At 600 w	At 1200 w	At 1800 w	At 600 w	At 1200 w	At 1800 w
1	5.73×10^{8}	3.44×10^{6}	6.88×10^{6}	1.031×10^{7}	1.08×10^{5}	2.21×10^{5}	3.09×10^{5}
2	1.89×10^{9}	1.136×10^{7}	2.272×10^{7}	3.408×10^{7}	3.55×10^{5}	7.29×10^{5}	1.02×10^{6}
3	4.25×10^{9}	2.55×10^{7}	5.10×10^{7}	7.65×10^{7}	7.98×10^{5}	1.64×10^{6}	2.30×10^{6}
4	8.79×10^{9}	5.27×10^{7}	1.055×10^{8}	1.582×10^{8}	1.65×10^{6}	3.39×10^{6}	4.75×10^{6}
5	1.85×10^{10}	1.11×10^{8}	2.22×10^{8}	3.33×10^{8}	3.47×10^{6}	7.13×10^{6}	1.00×10^{7}
6	3.85×10^{10}	2.31×10^{8}	4.62×10^{8}	6.93×10^{8}	7.228×10^{6}	1.483×10^{7}	2.080×10^{7}

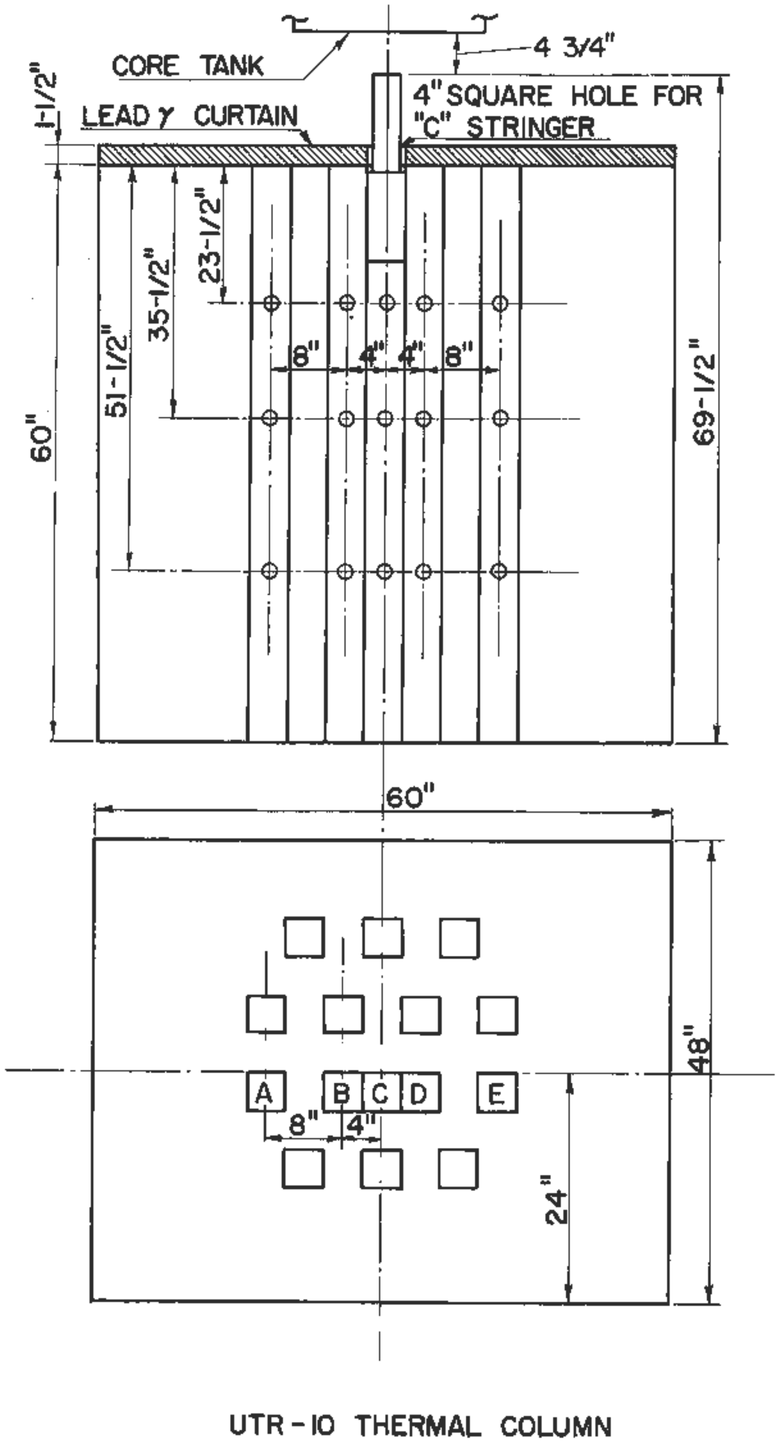
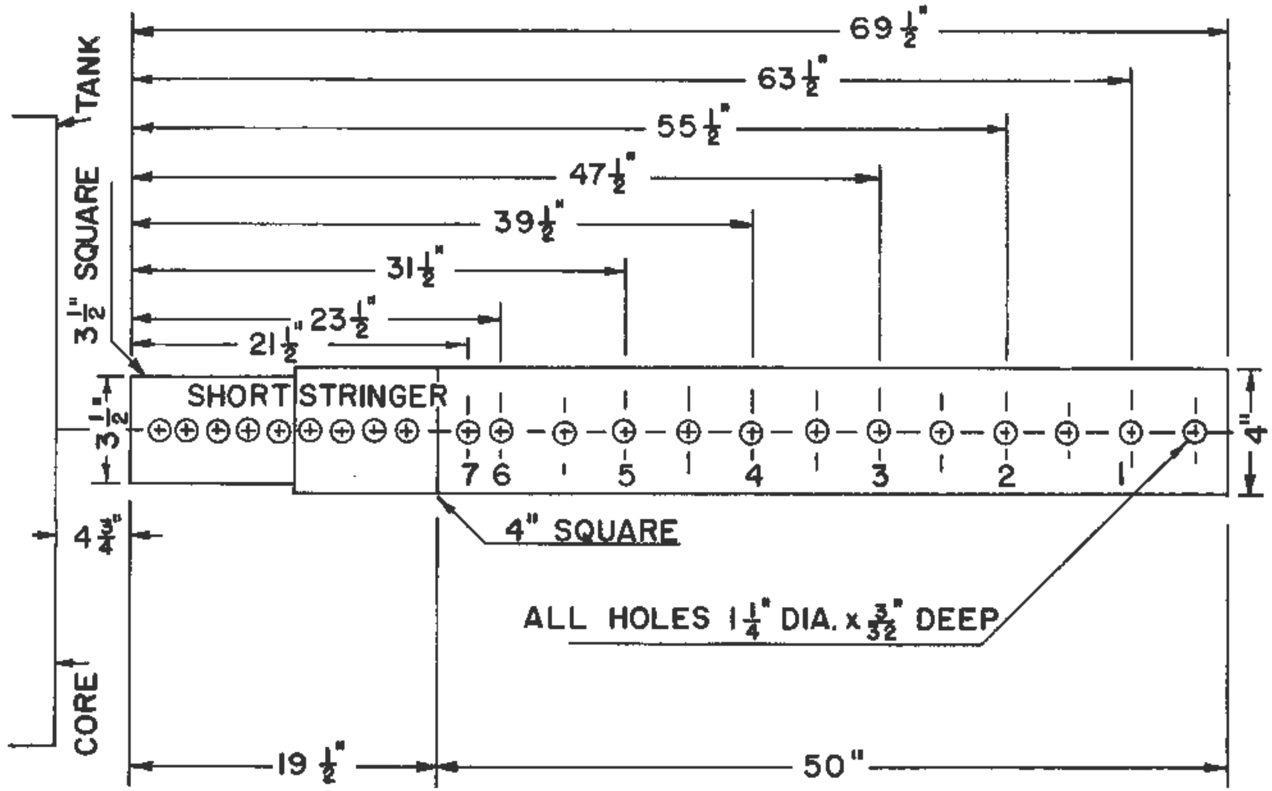


Fig. 1. UTR-10 thermal column



CENTRAL STRINGER IN THERMAL COLUMN

Fig. 2. Central stringer in thermal column

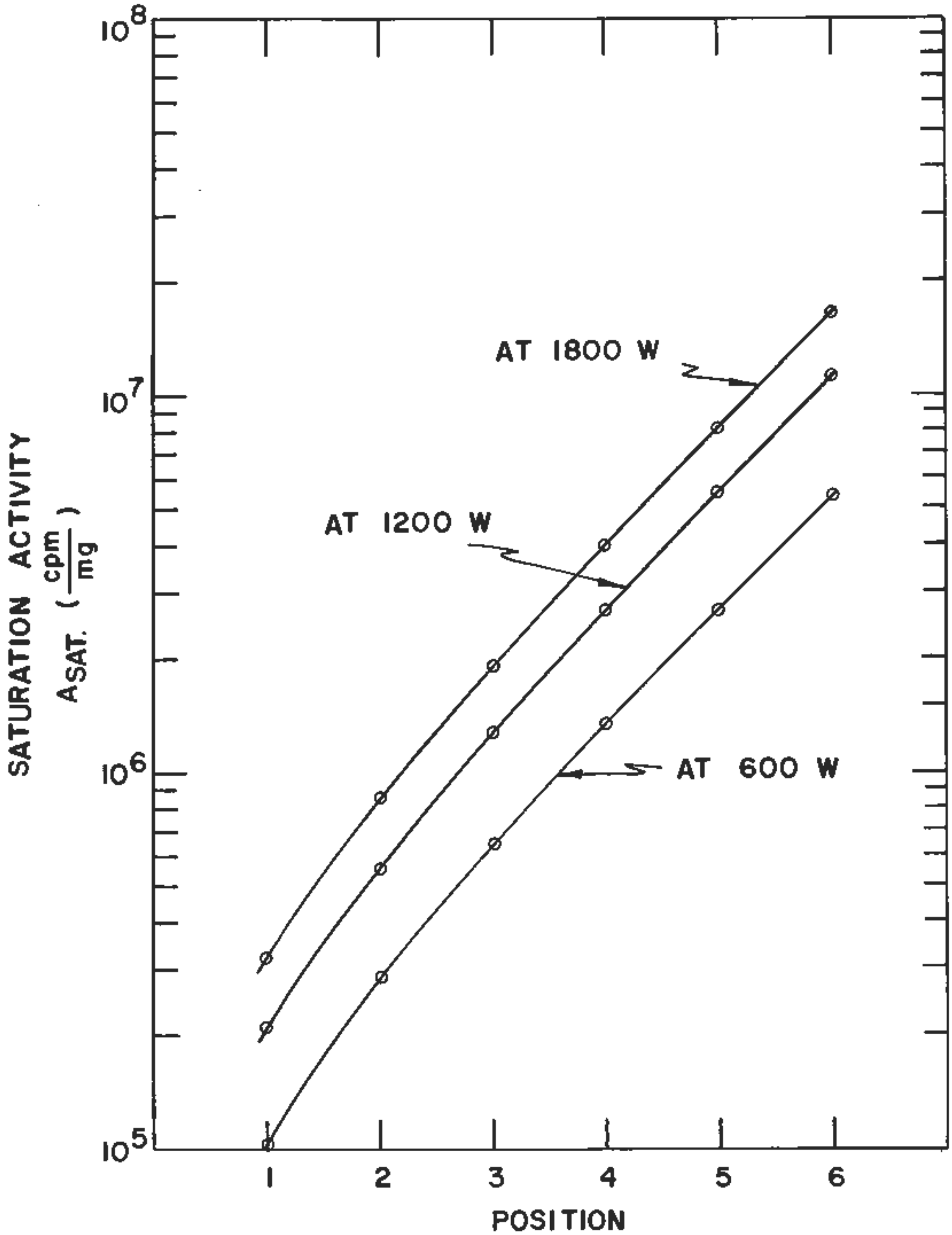


Fig. 3. Saturation activities of bare indium foils along the central stringer A of the thermal column

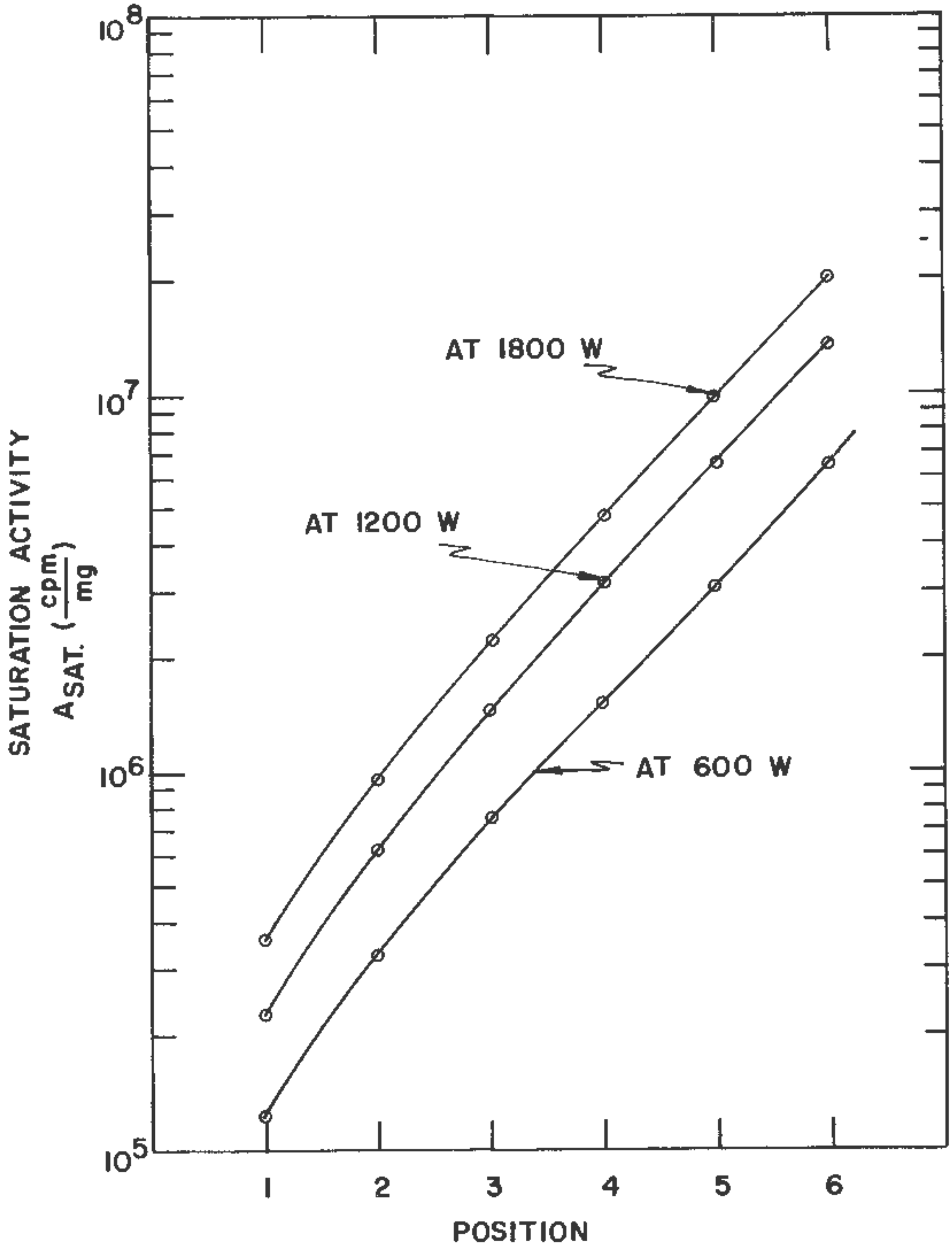


Fig. 4. Saturation activities of bare indium foils along the central stringer B of the thermal column

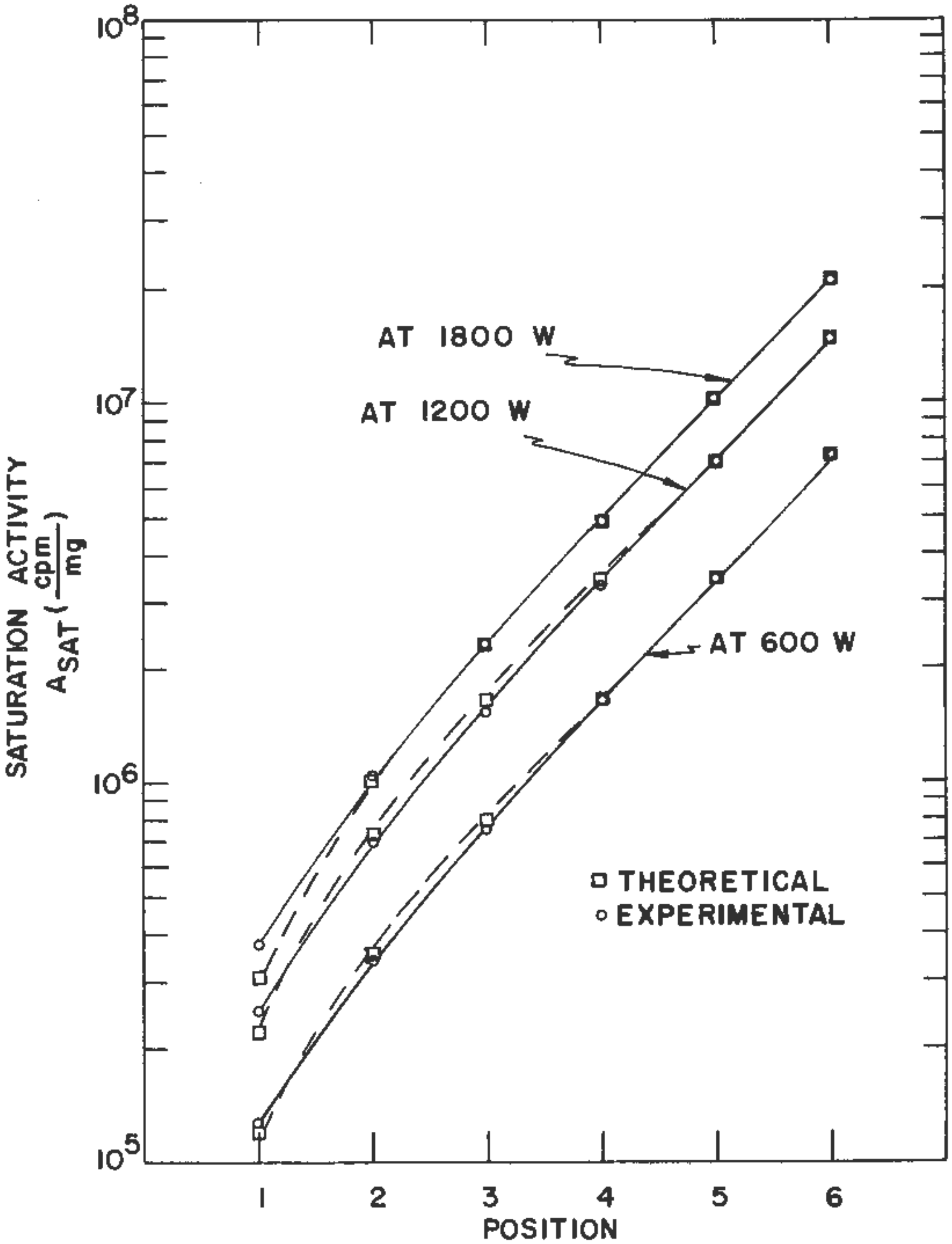


Fig. 5. Saturation activities of bare indium foils along the central stringer C of the thermal column

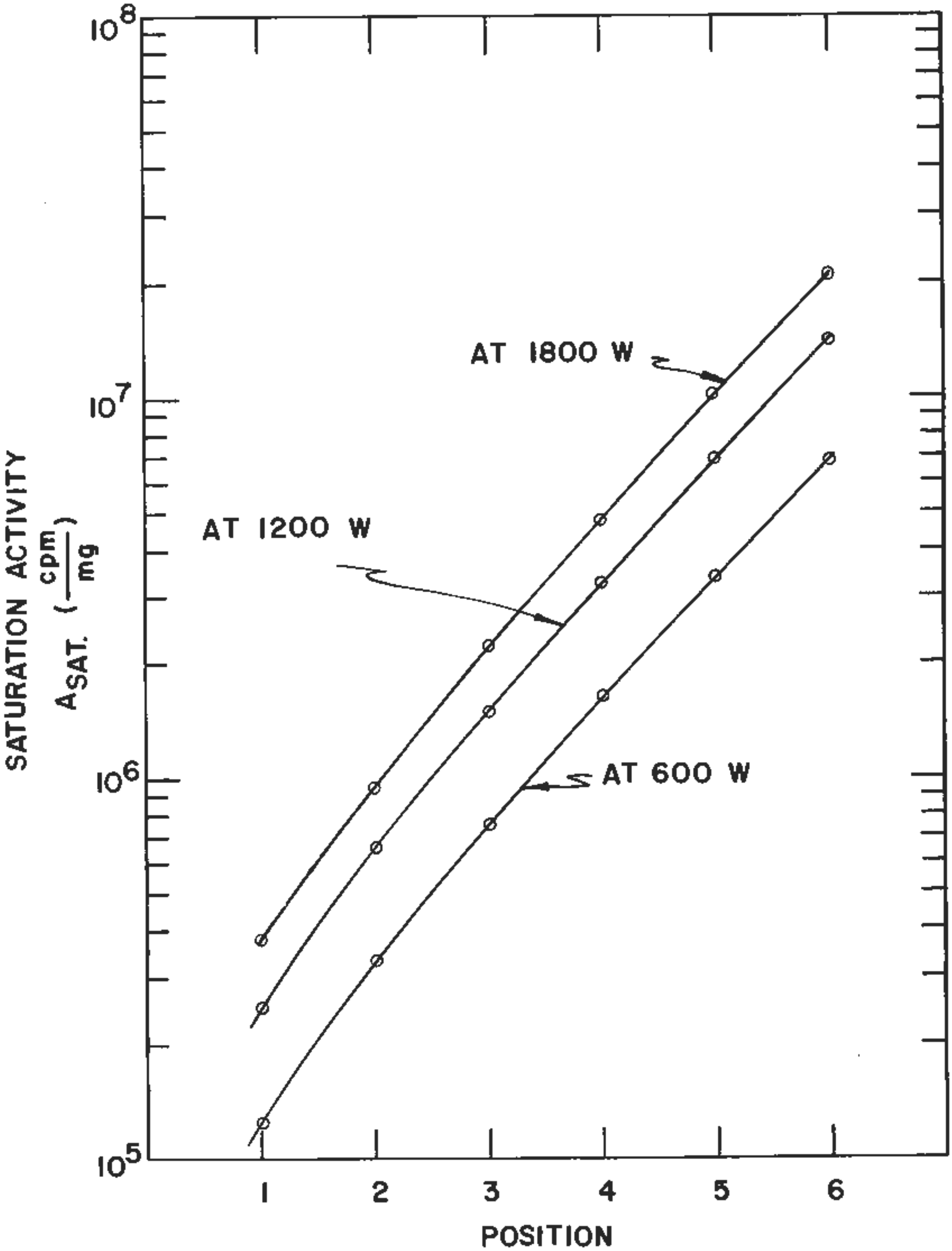


Fig. 6. Saturation activities of bare indium foils along the central stringer D of the thermal column

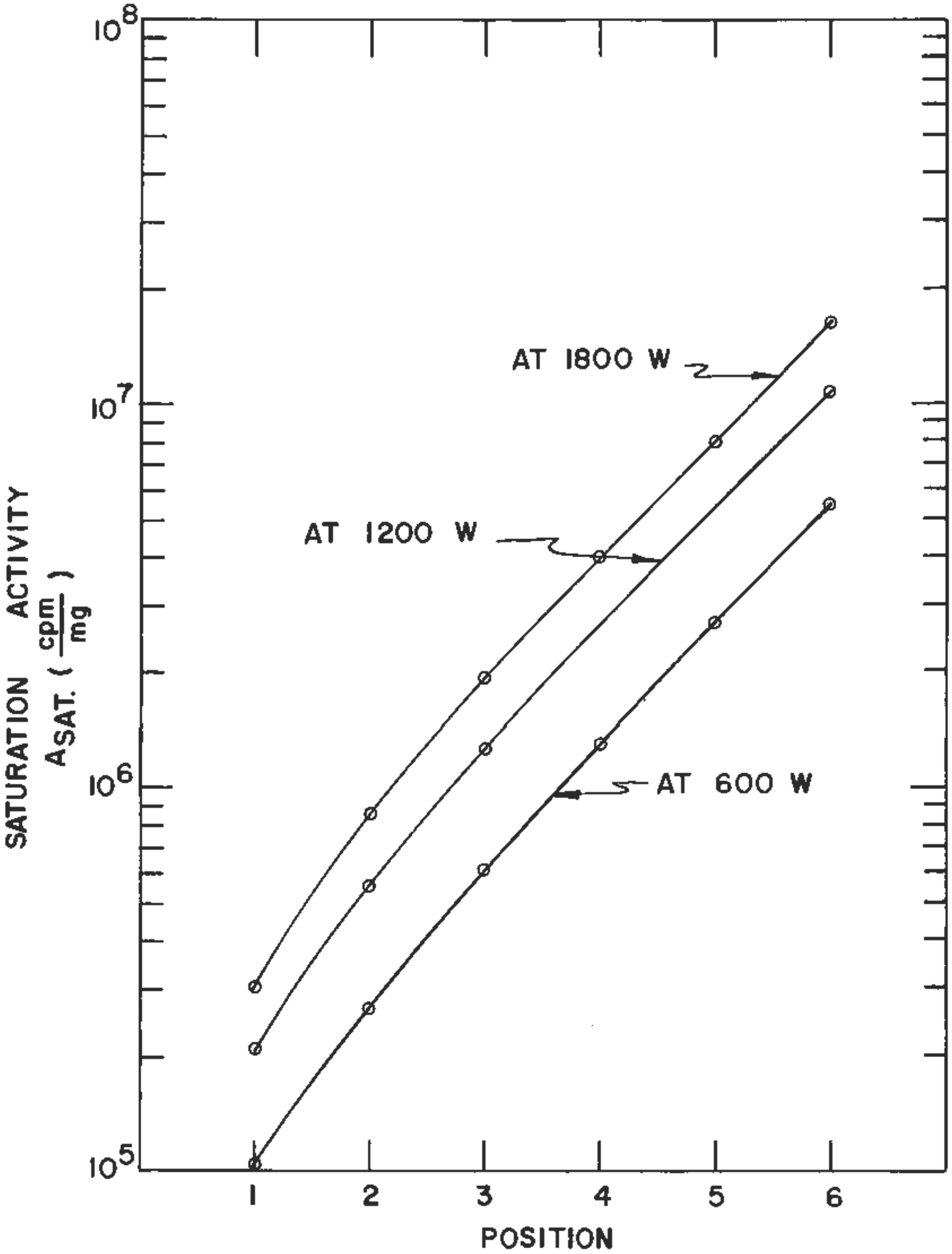


Fig. 7. Saturation activities of bare indium foils along the central stringer E of the thermal column

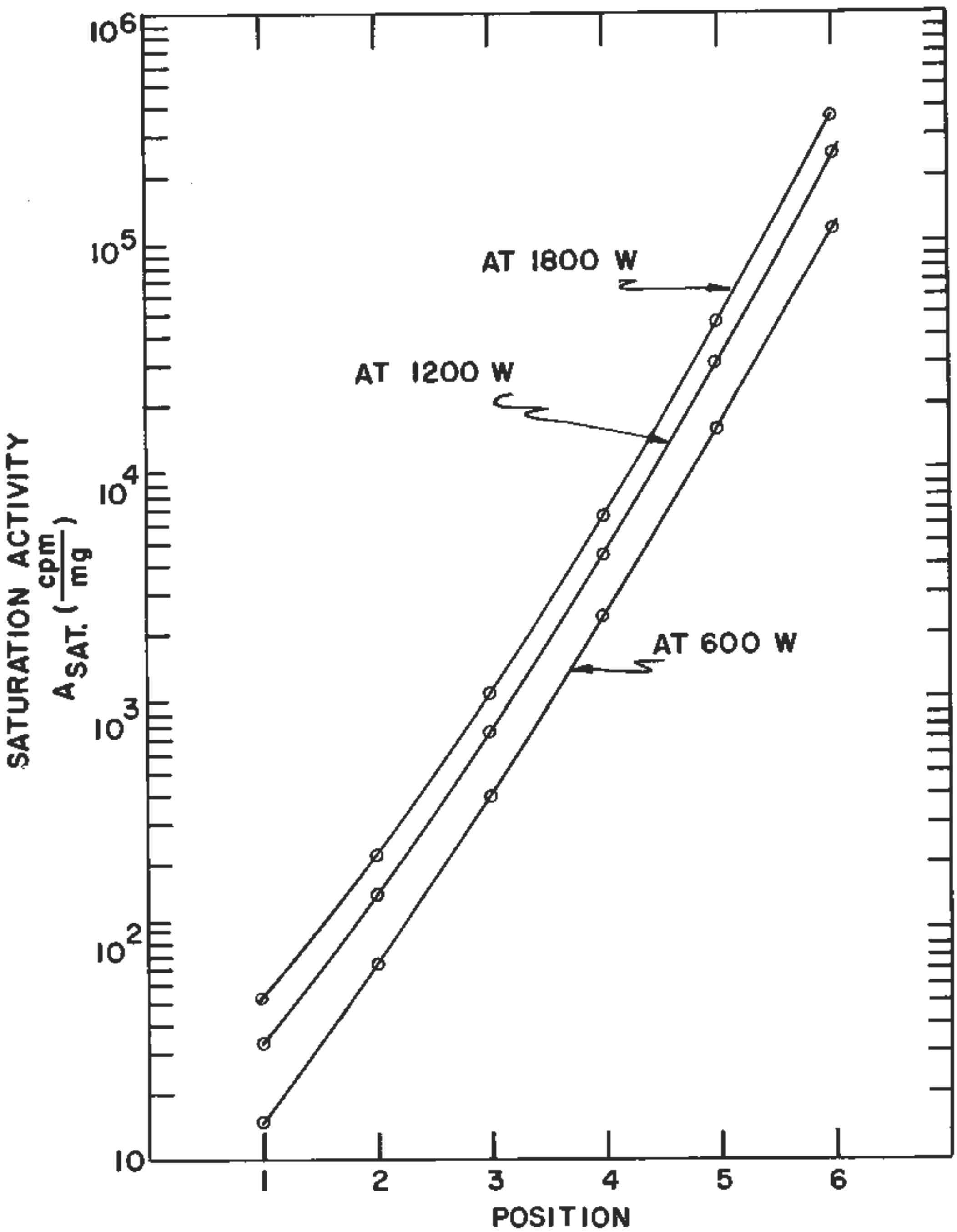


Fig. 8. Saturation activities of cadmium-covered indium foils along the central stringer A of the thermal column

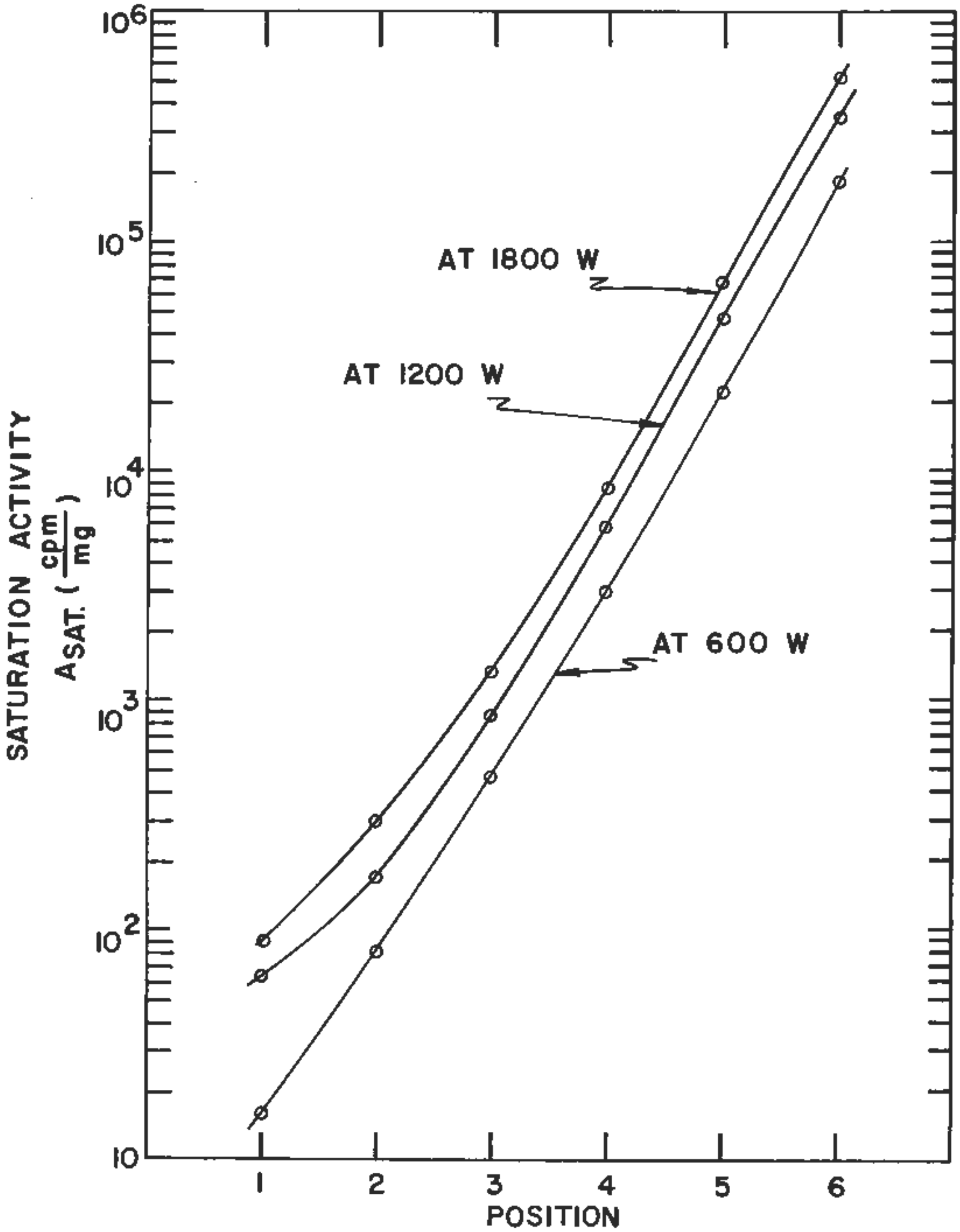


Fig. 9. Saturation activities of cadmium-covered indium foils along the central stringer B of the thermal column

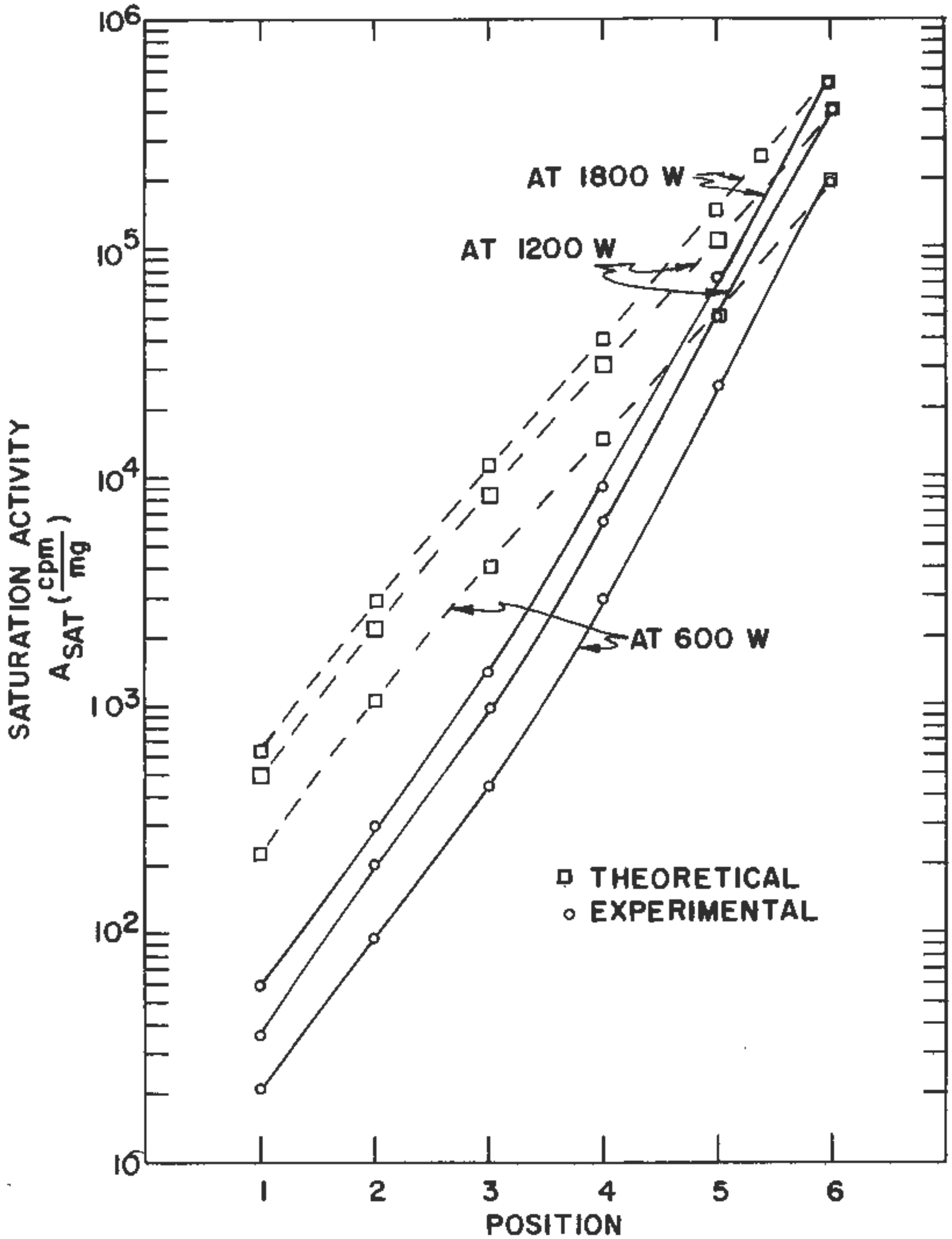


Fig. 10. Saturation activities of cadmium-covered indium foils along the central stringer C of the thermal column

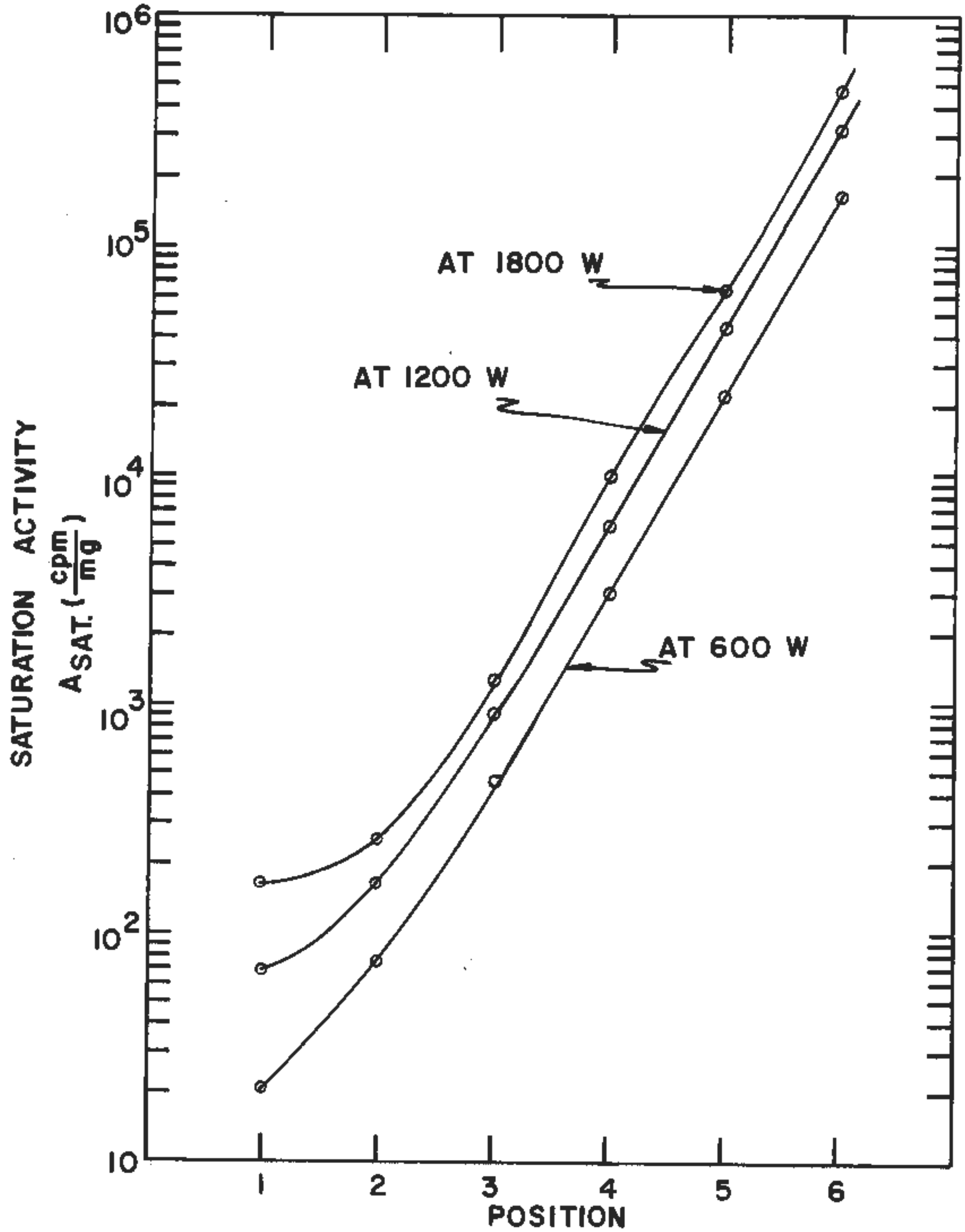


Fig. 11. Saturation activities of cadmium-covered indium foils along the central stringer D of the thermal column

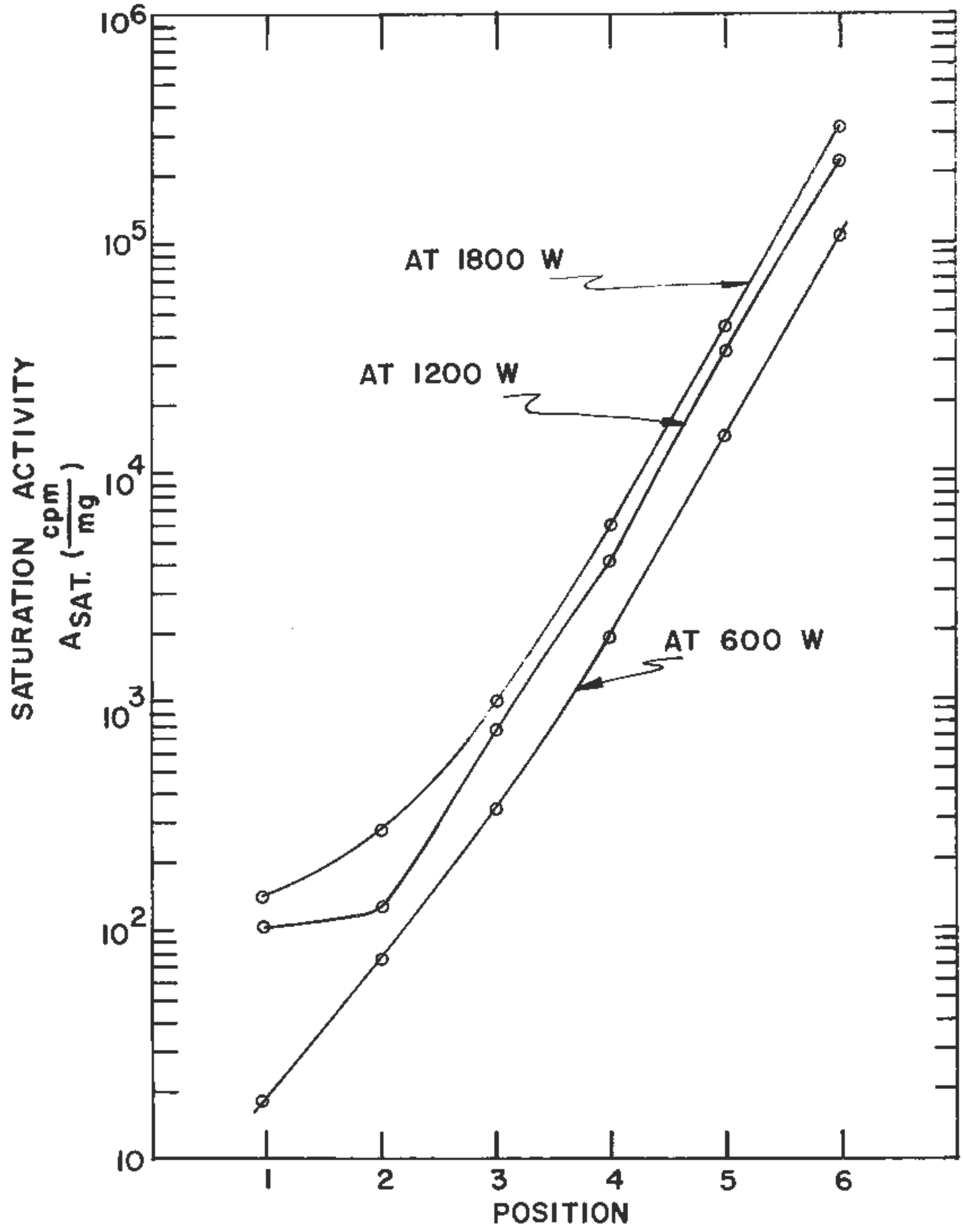


Fig. 12. Saturation activities of cadmium-covered indium foils along the central stringer E of the thermal column

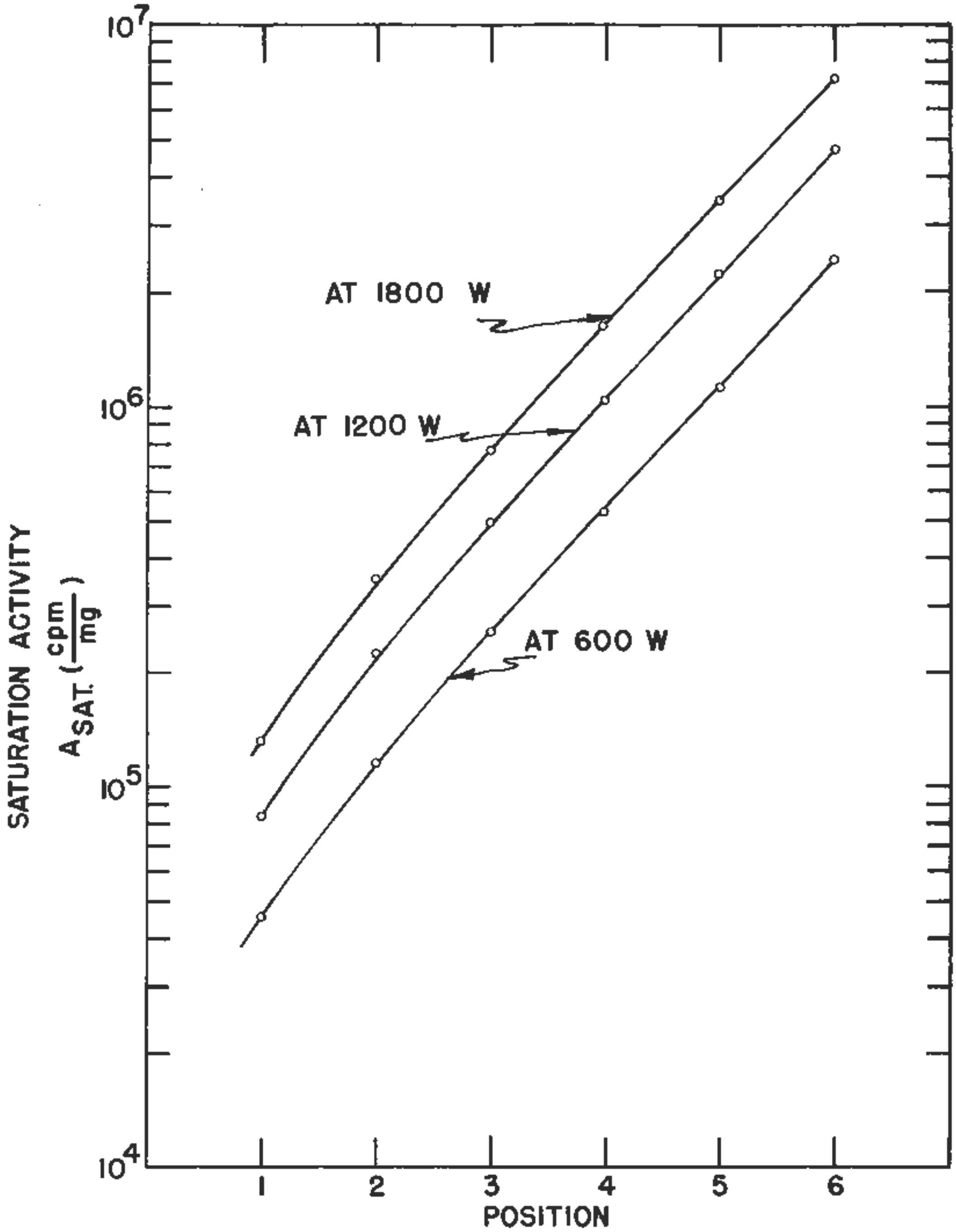


Fig. 13. Saturation activities of bare gold foils along the central stringer A of the thermal column

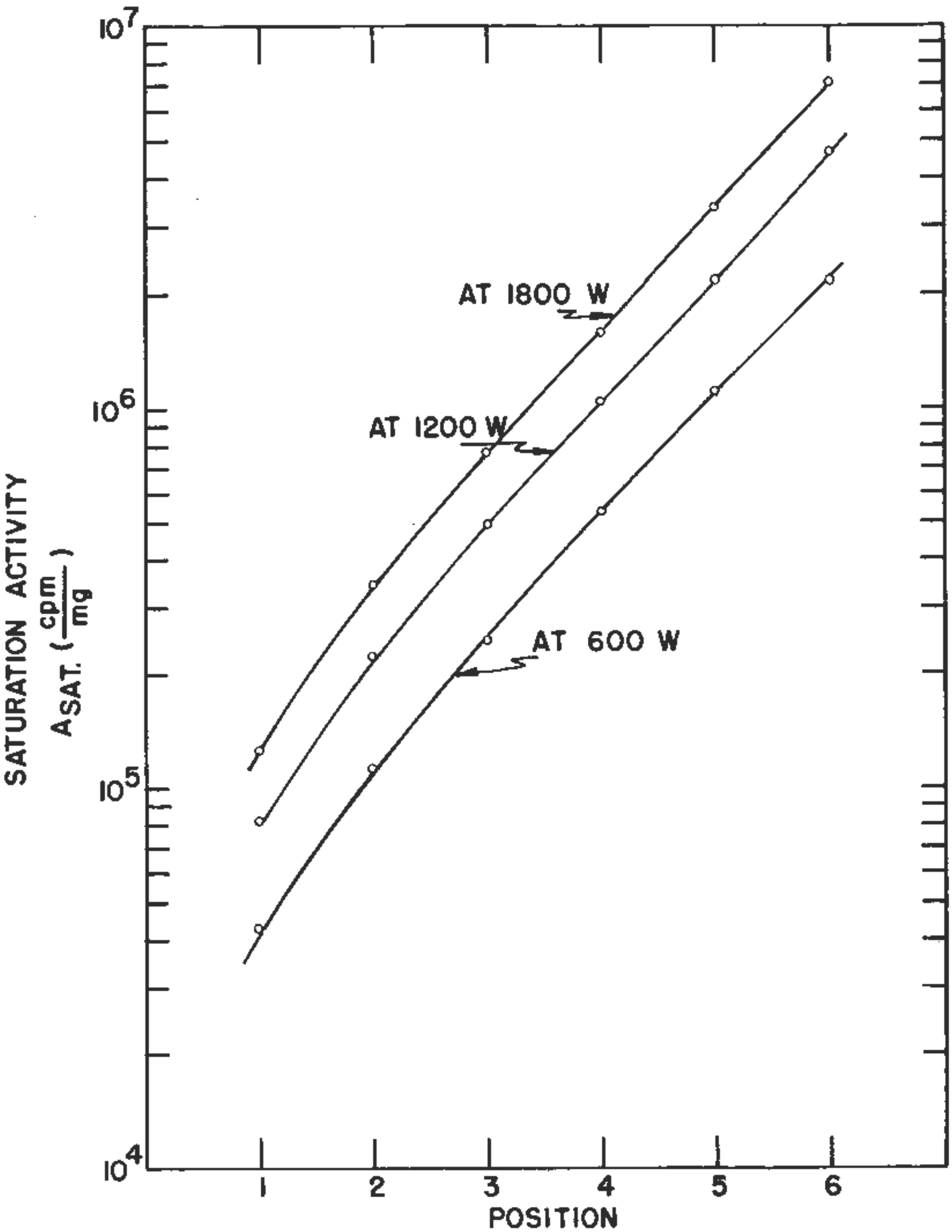


Fig. 14. Saturation activities of bare gold foils along the central stringer B of the thermal column

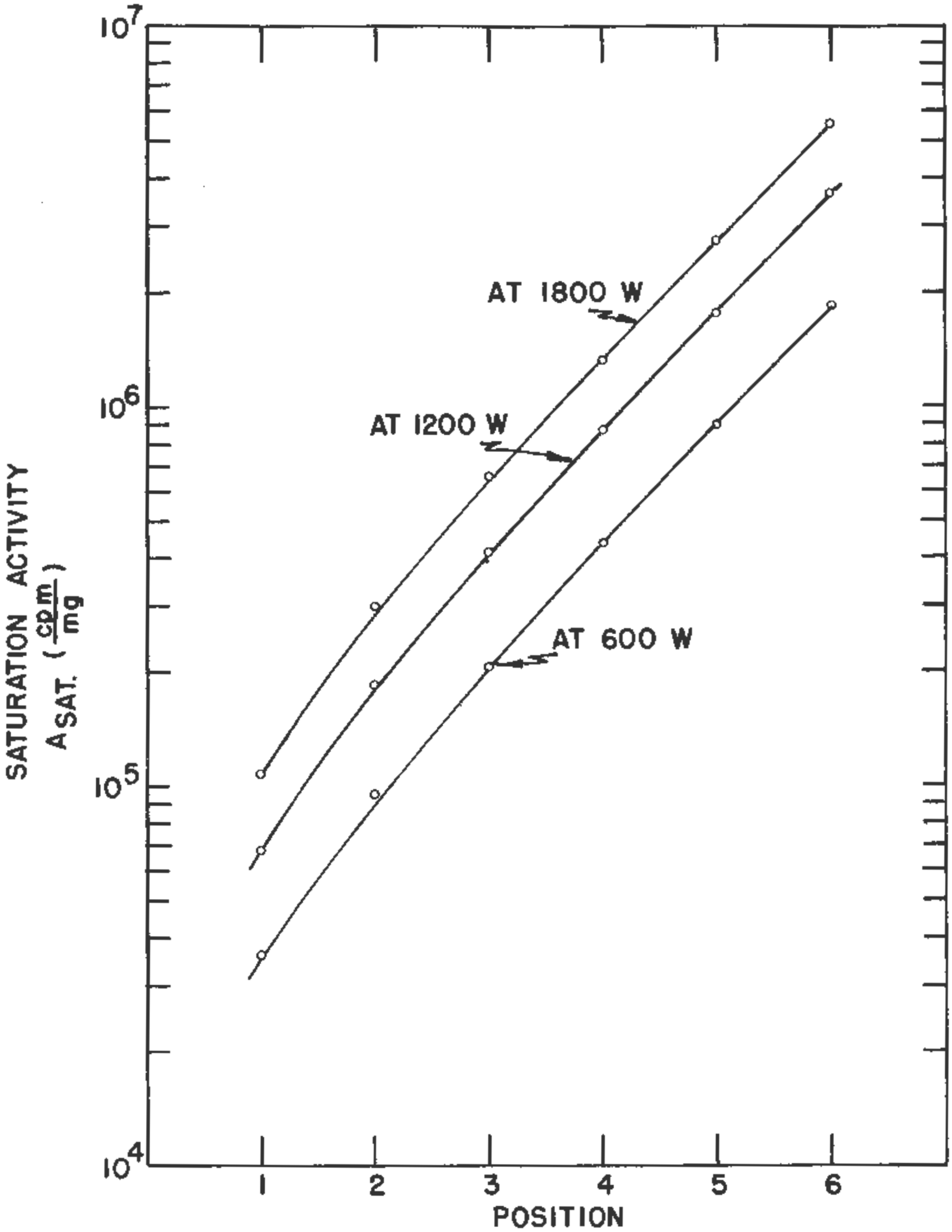


Fig. 15. Saturation activities of bare gold foils along the central stringer C of the thermal column

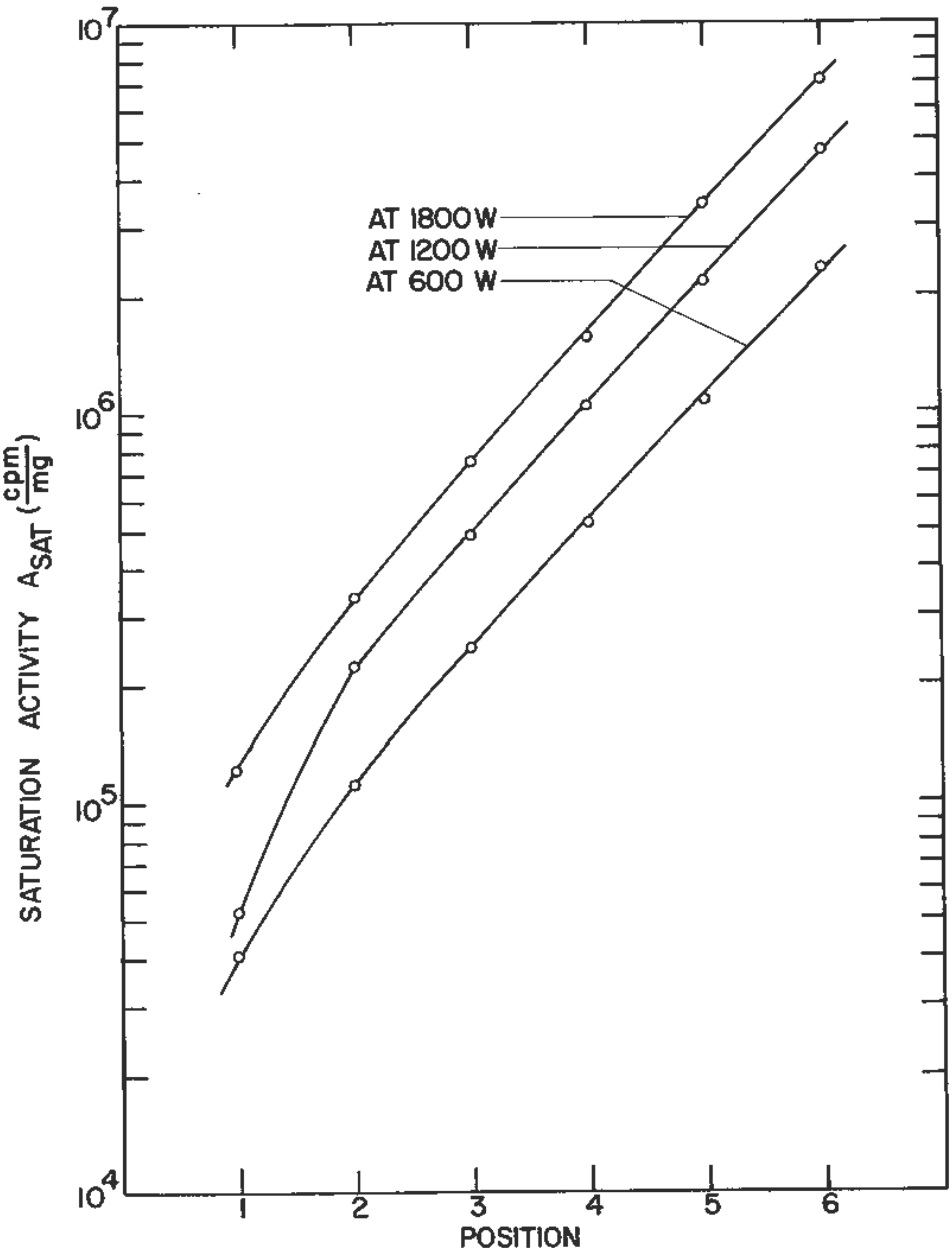


Fig. 16. Saturation activities of bare gold foils along the central stringer D of the thermal column

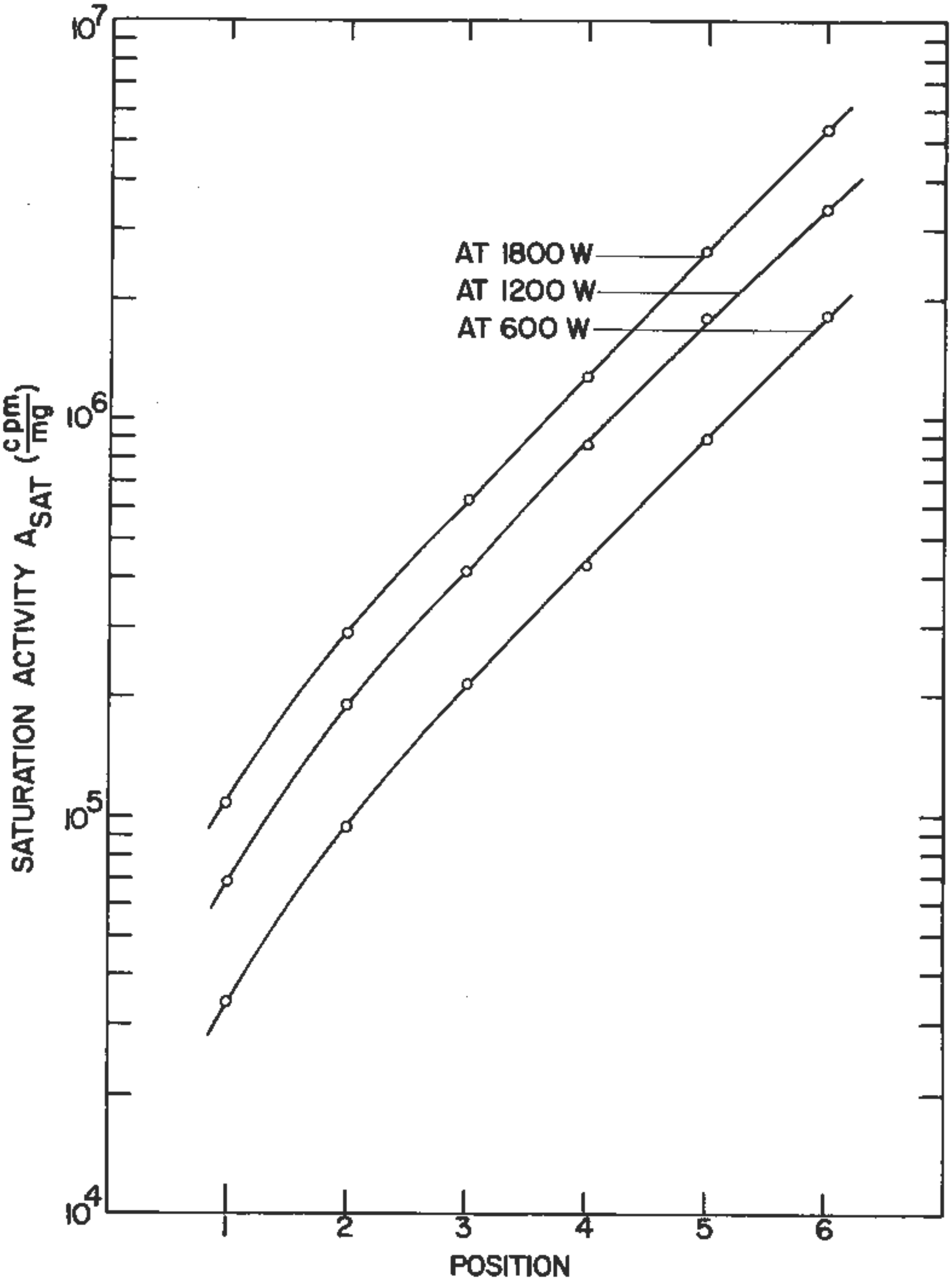


Fig. 17. Saturation activities of bare gold foils along the central stringer E of the thermal column

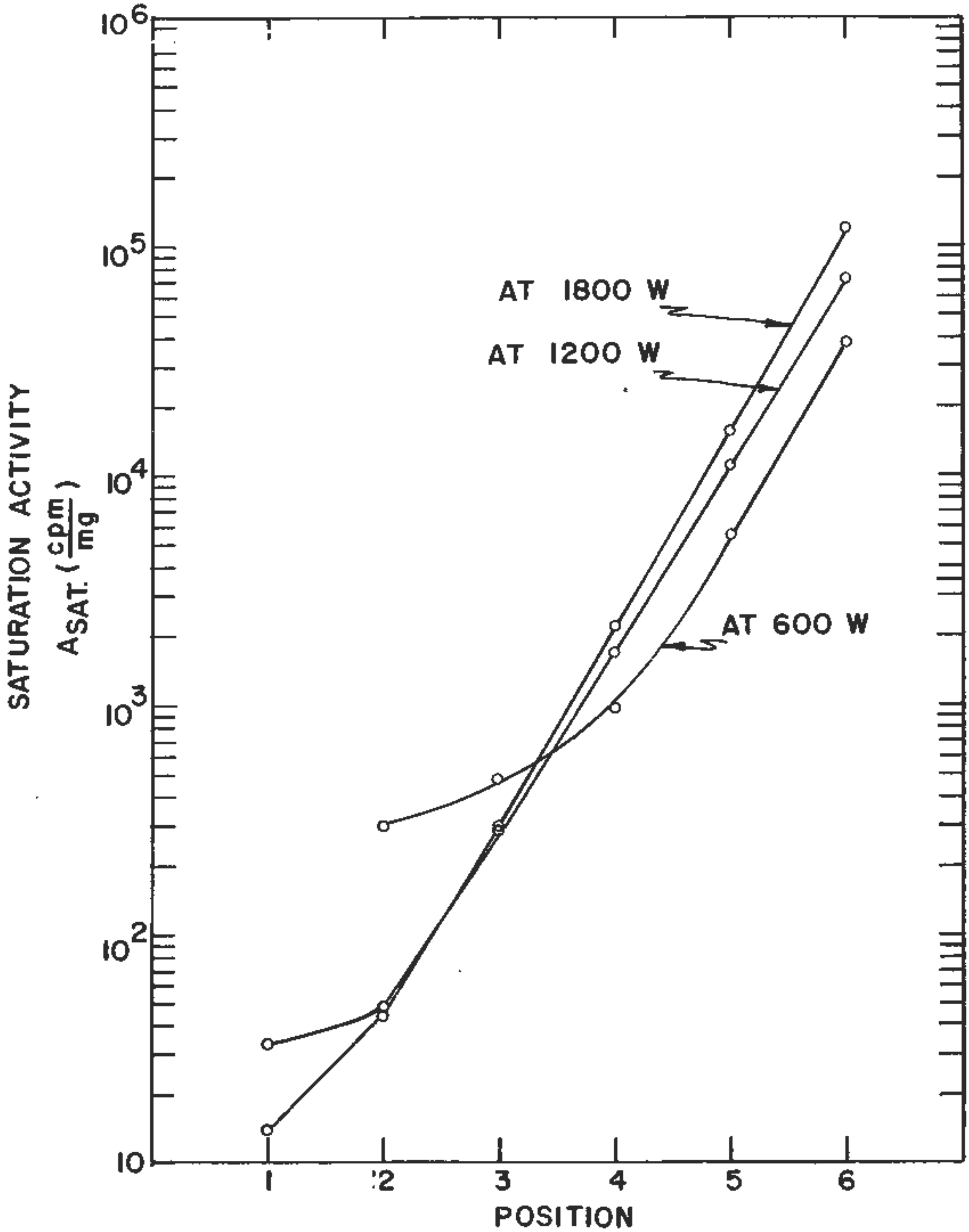


Fig. 18. Saturation activities of cadmium-covered gold foils along the central stringer A of the thermal column

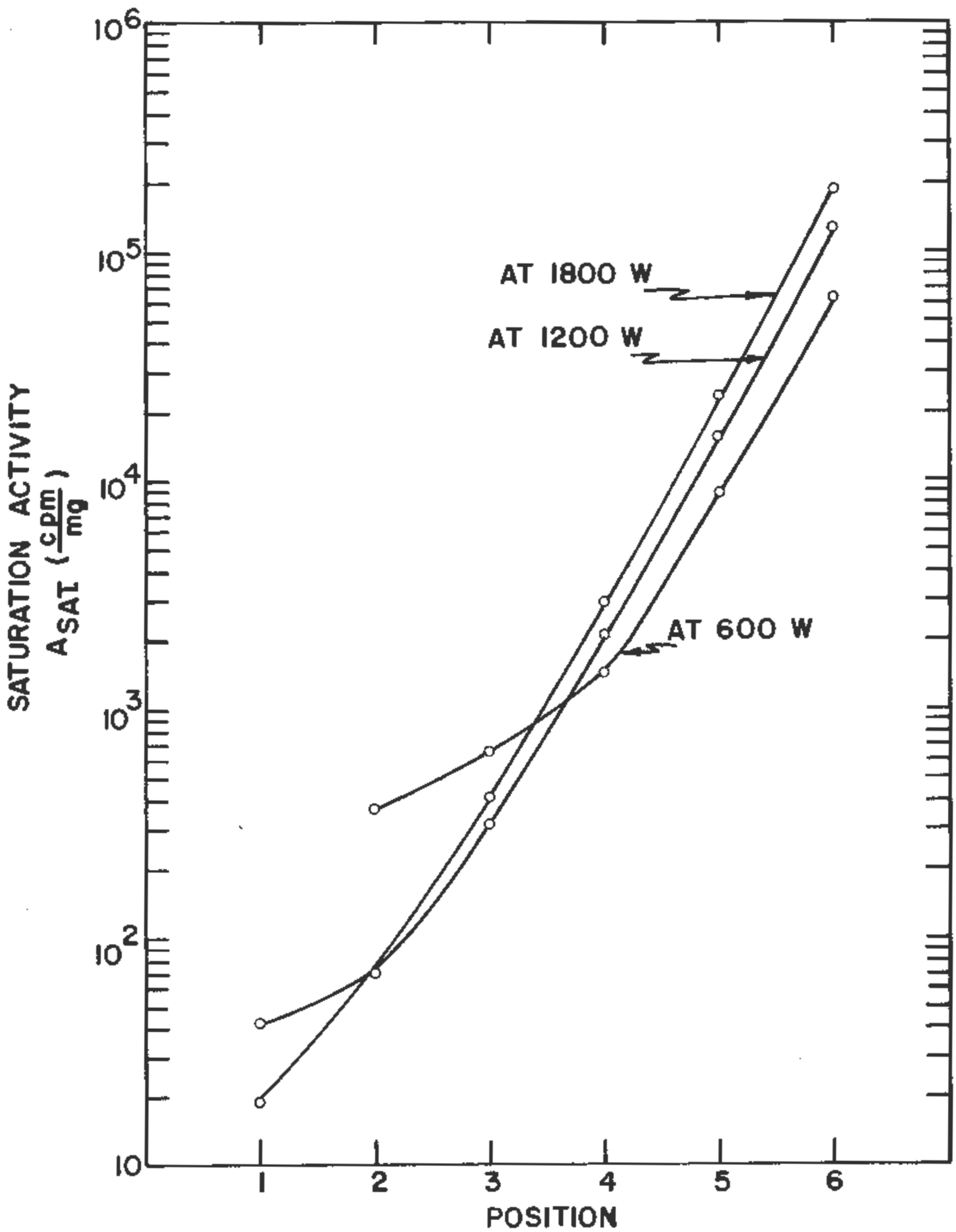


Fig. 19. Saturation activities of cadmium-covered gold foils along the central stringer B of the thermal column

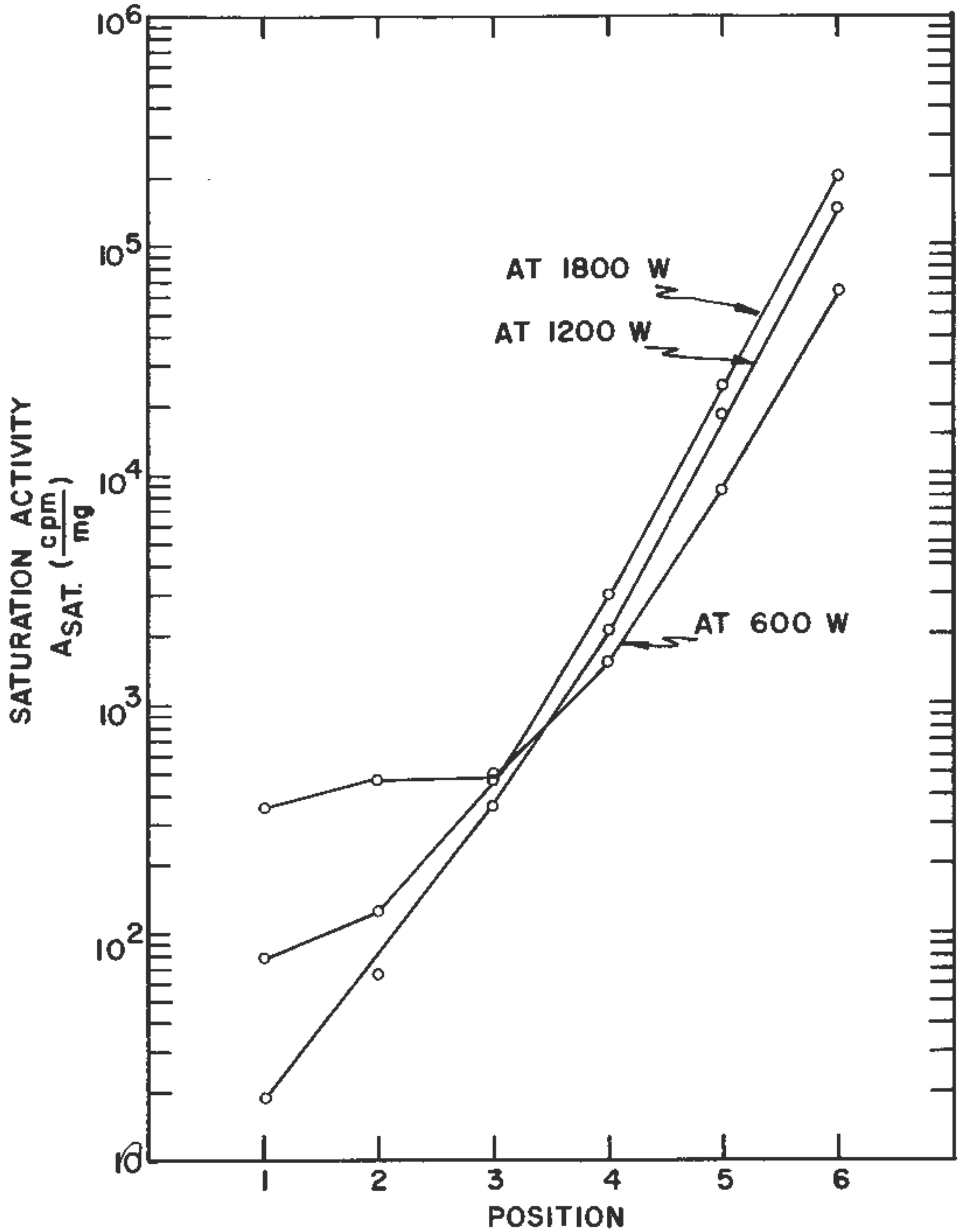


Fig. 20. Saturation activities of cadmium-covered gold foils along the central stringer C of the thermal column

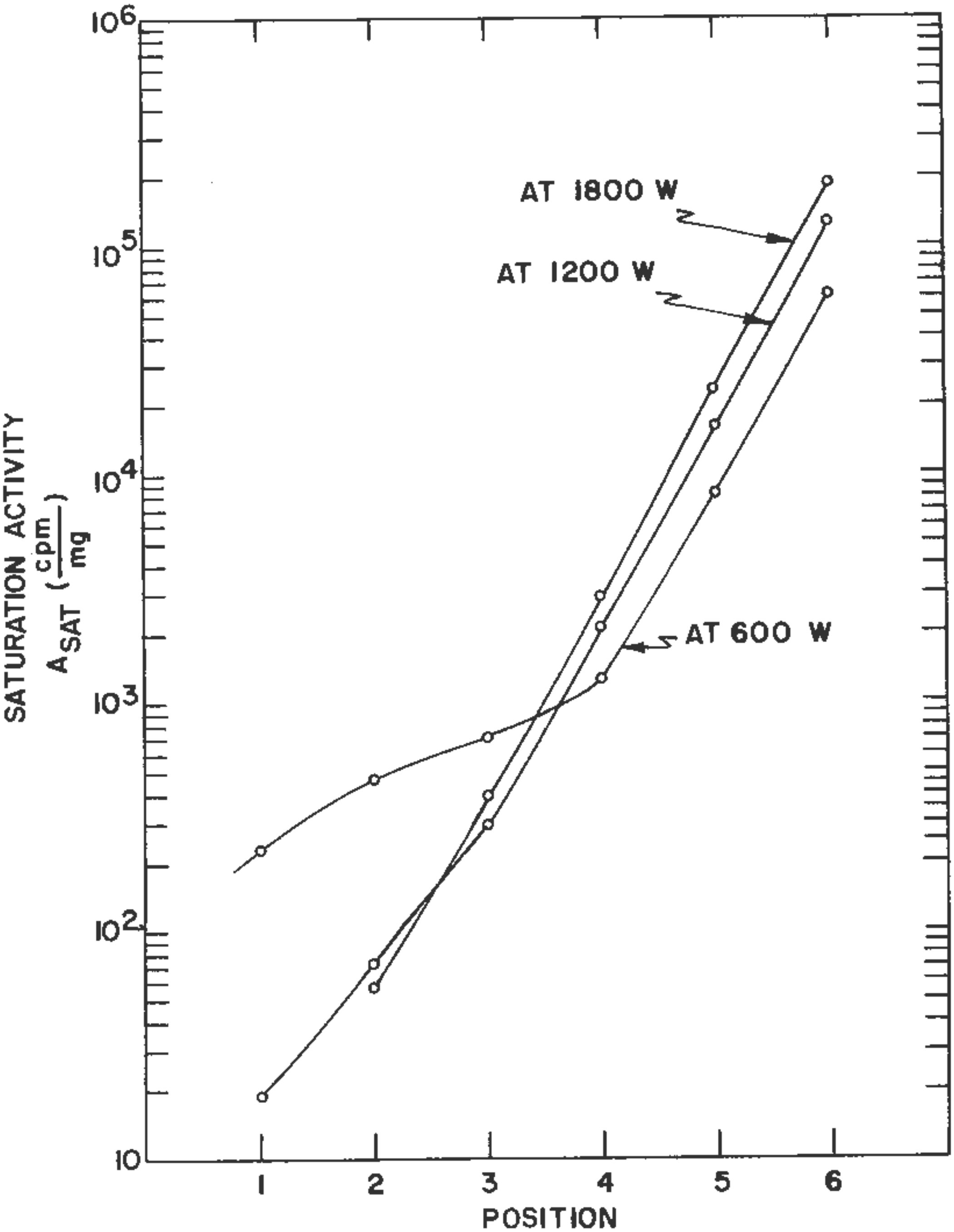


Fig. 21. Saturation activities of cadmium-covered gold foils along the central stringer D of the thermal column

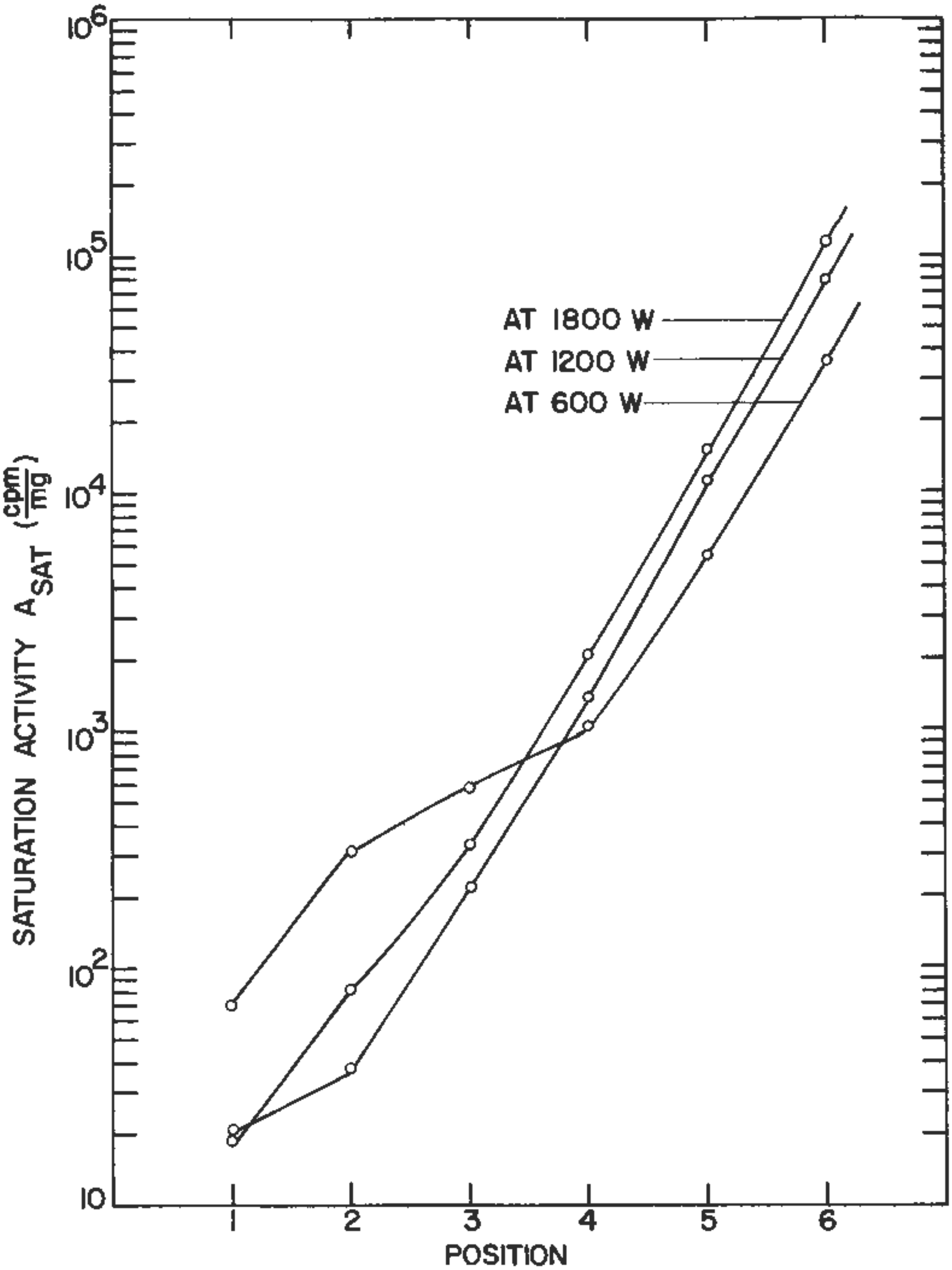


Fig. 22. Saturation activities of cadmium-covered gold foils along the central stringer E of the thermal column

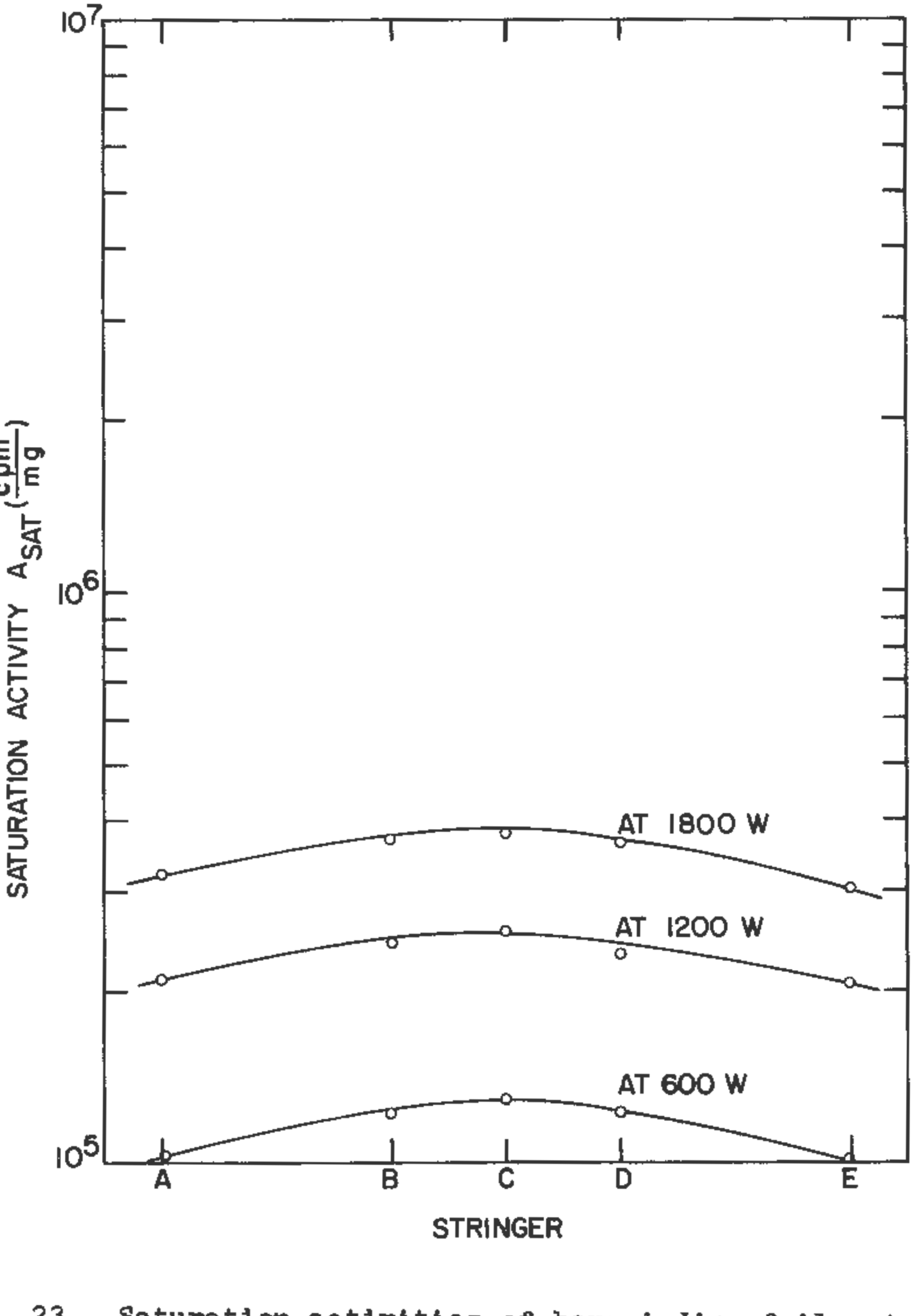


Fig. 23. Saturation activities of bare indium foils at Plane 1 across the central stringers of the thermal column

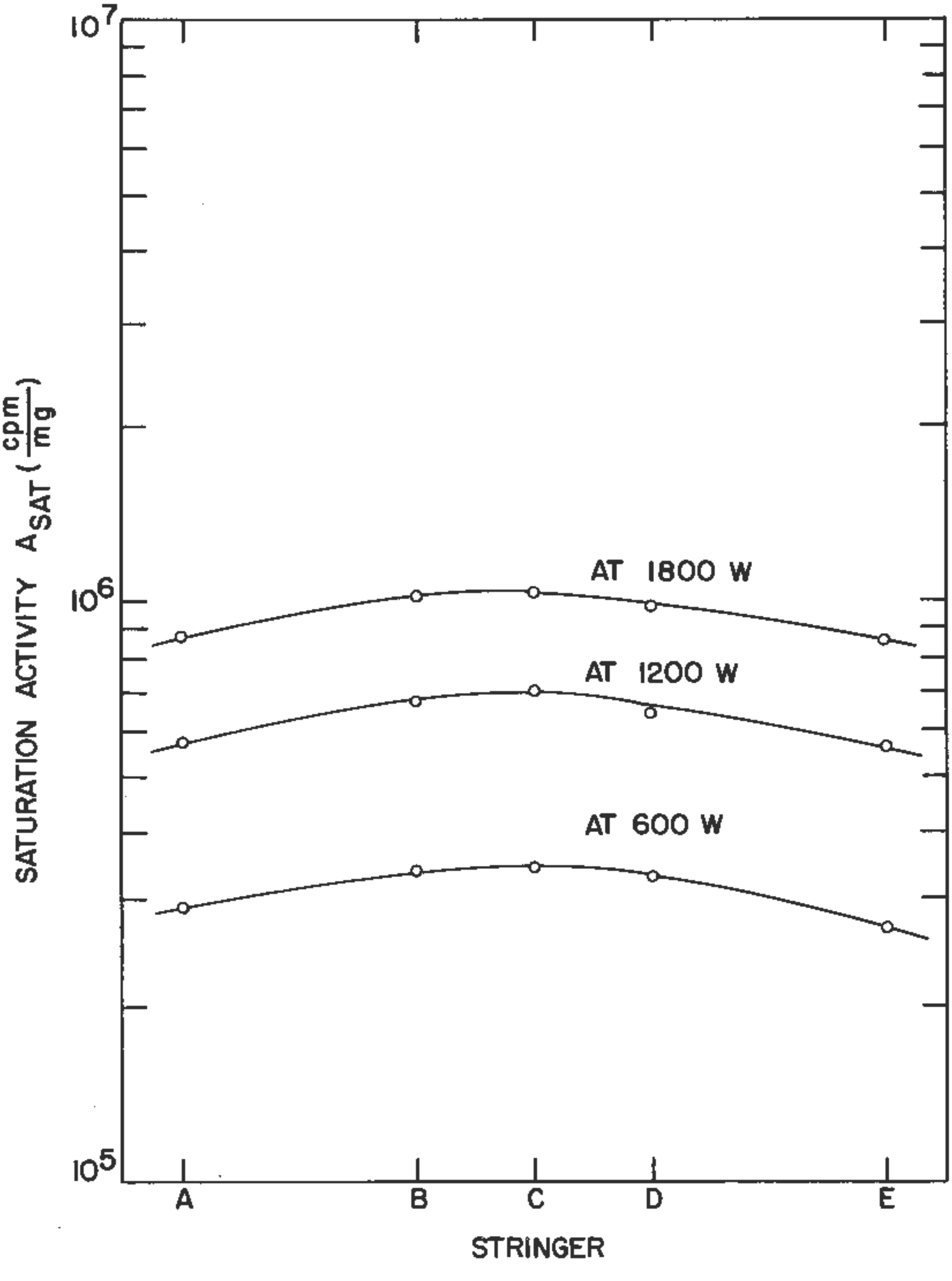


Fig. 24. Saturation activities of bare indium foils at Plane 2 across the central stringers of the thermal column

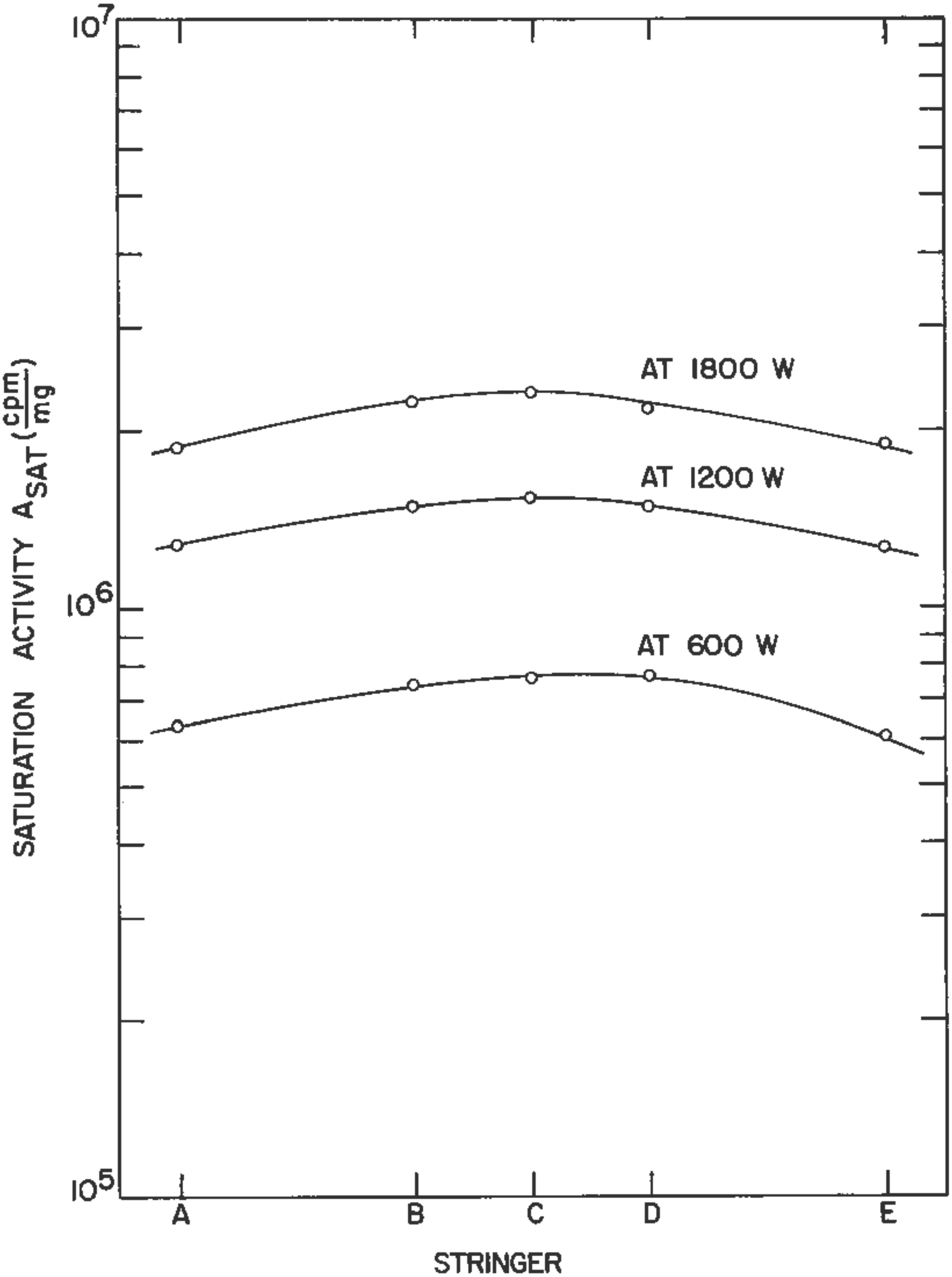


Fig. 25. Saturation activities of bare indium foils at Plane 3 across the central stringers of the thermal column

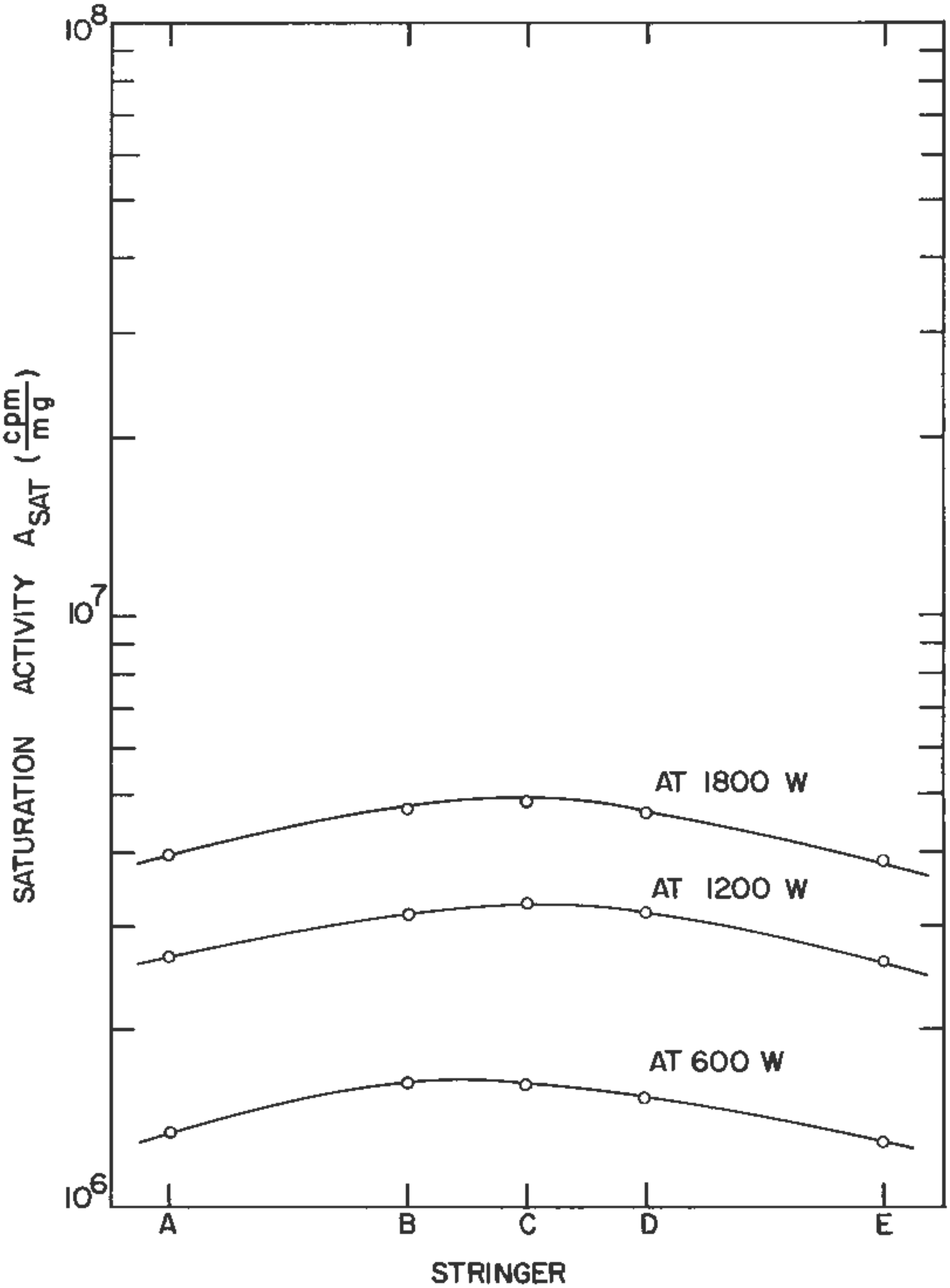


Fig. 26. Saturation activities of bare indium foils at Plane 4 across the central stringers of the thermal column

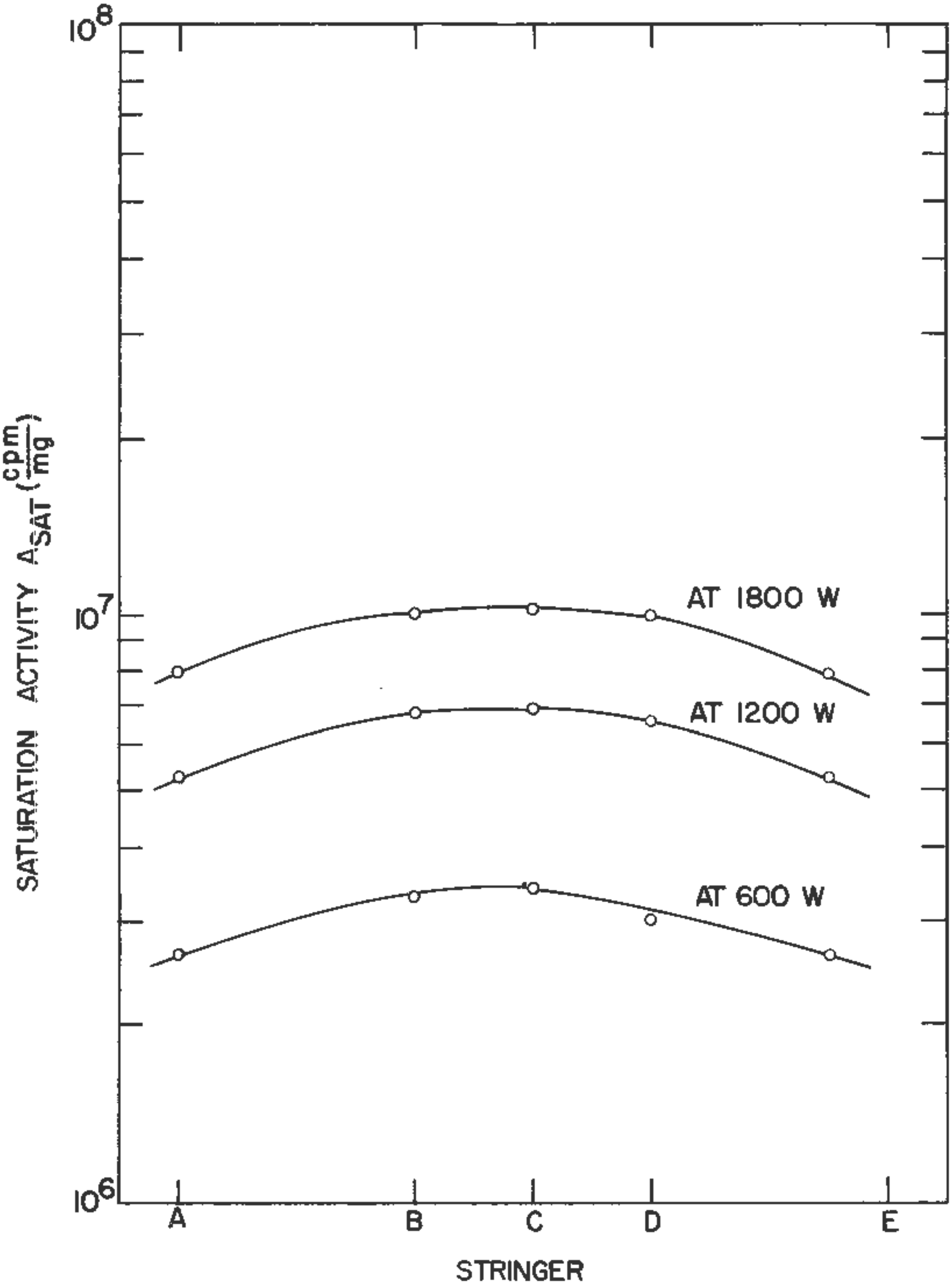


Fig. 27. Saturation activities of bare indium foils at Plane 5 across the central stringers of the thermal column

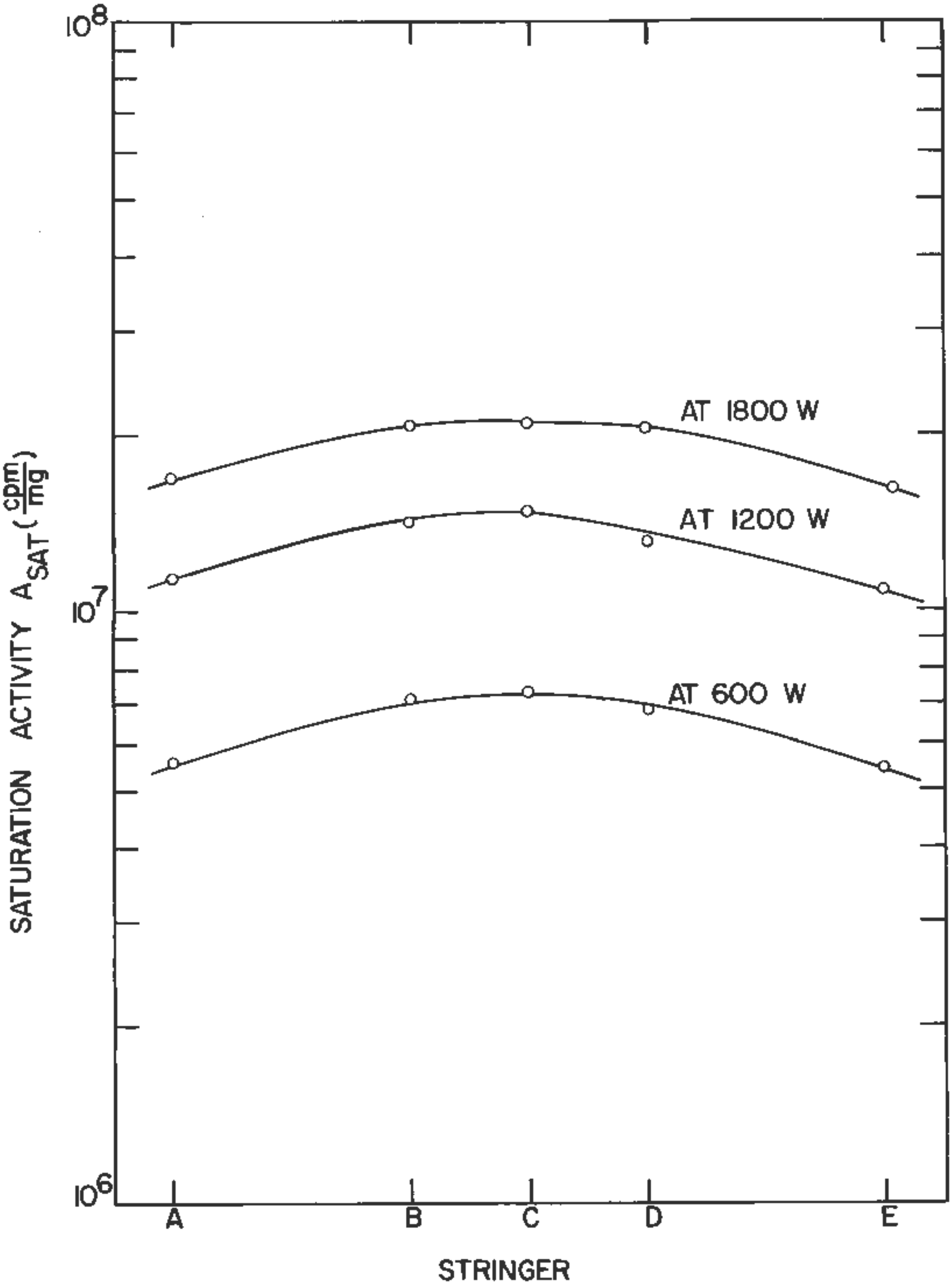


Fig. 28. Saturation activities of bare indium foils at Plane 6 across the central stringers of the thermal column

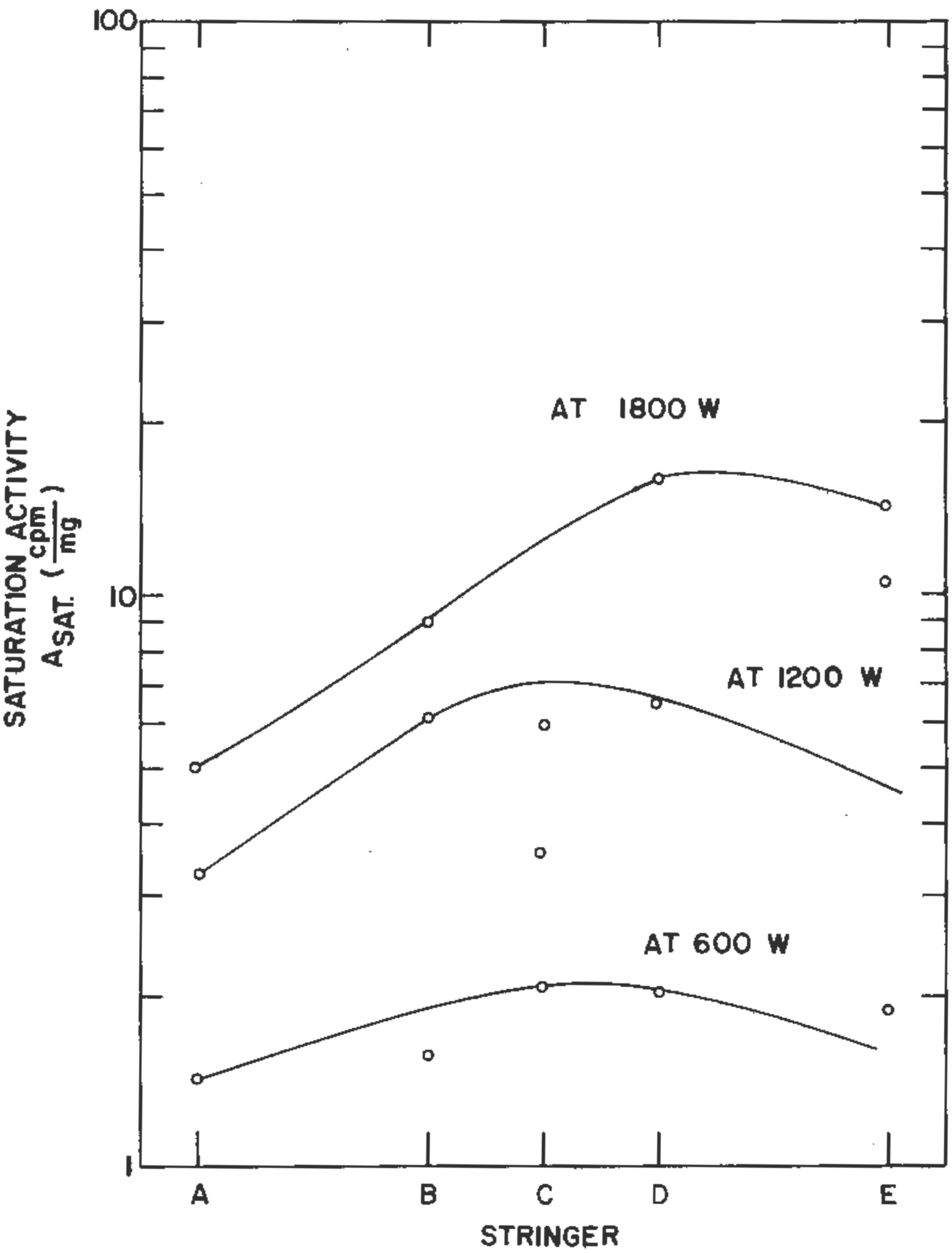


Fig. 29. Saturation activities of cadmium-covered indium foils at Plane 1 across the central stringers of the thermal column

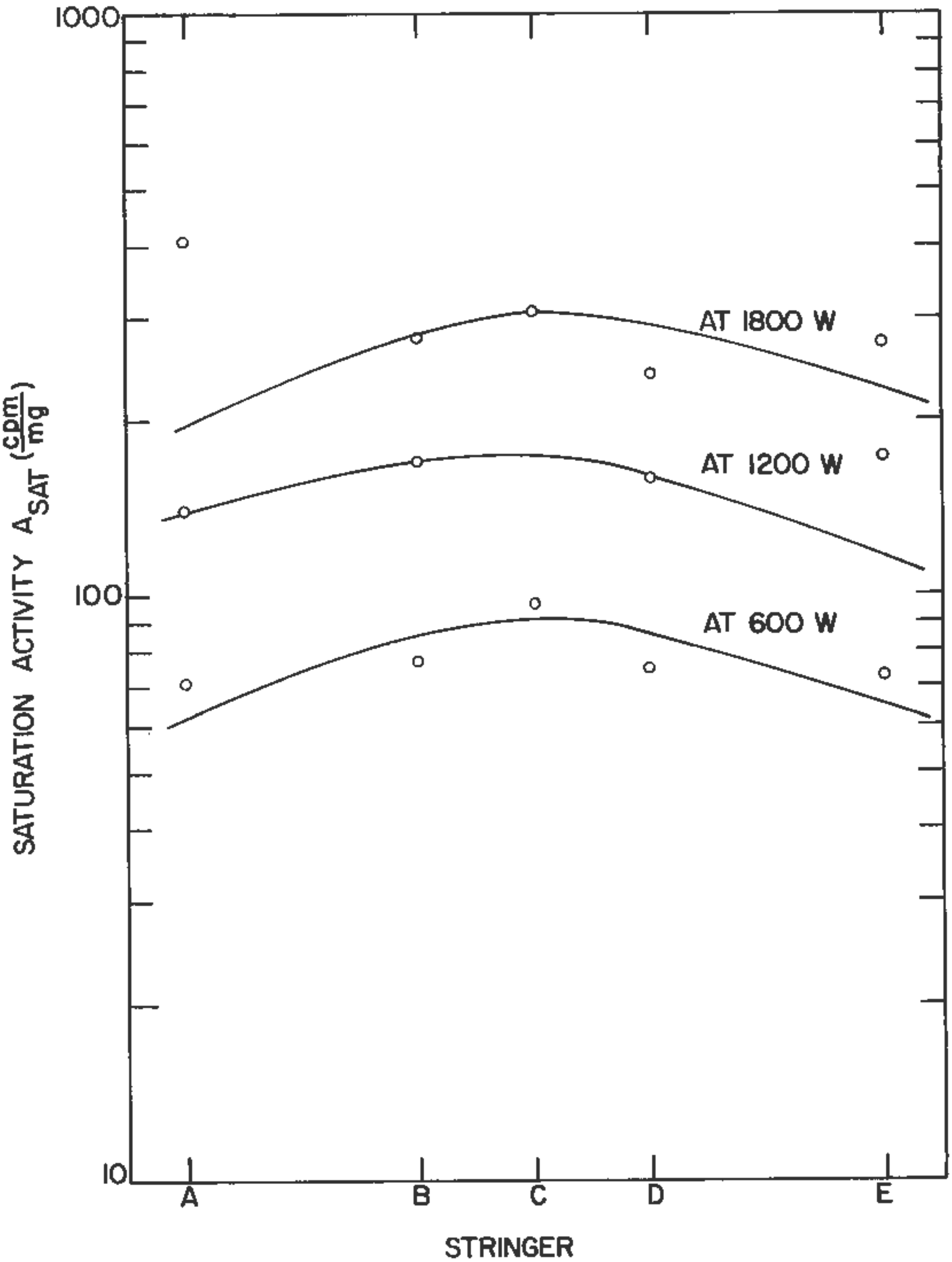


Fig. 30. Saturation activities of cadmium-covered indium foils at Plane 2 across the central stringers of the thermal column

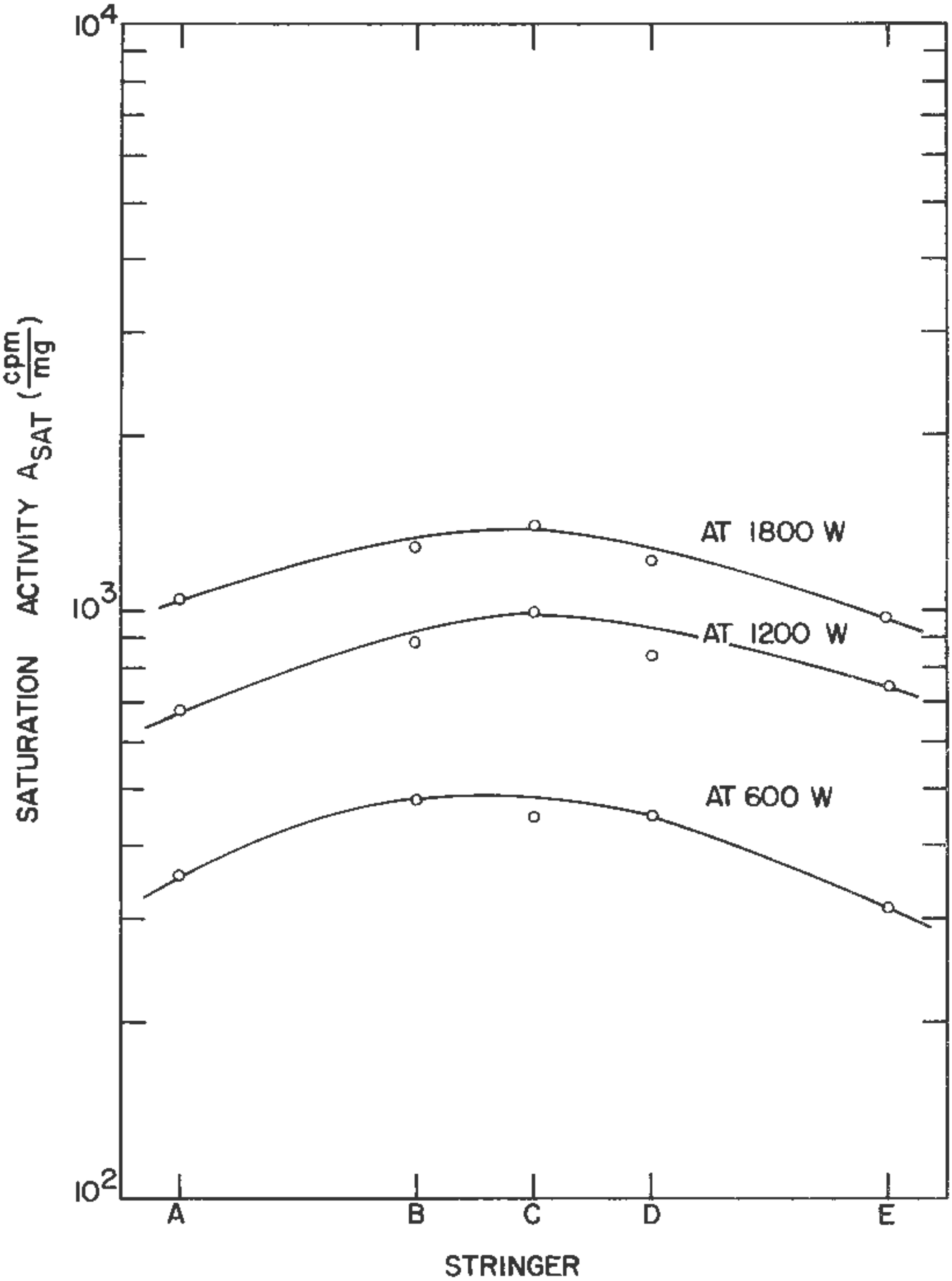


Fig. 31. Saturation activities of cadmium-covered indium foils at Plane 3 across the central stringers of the thermal column

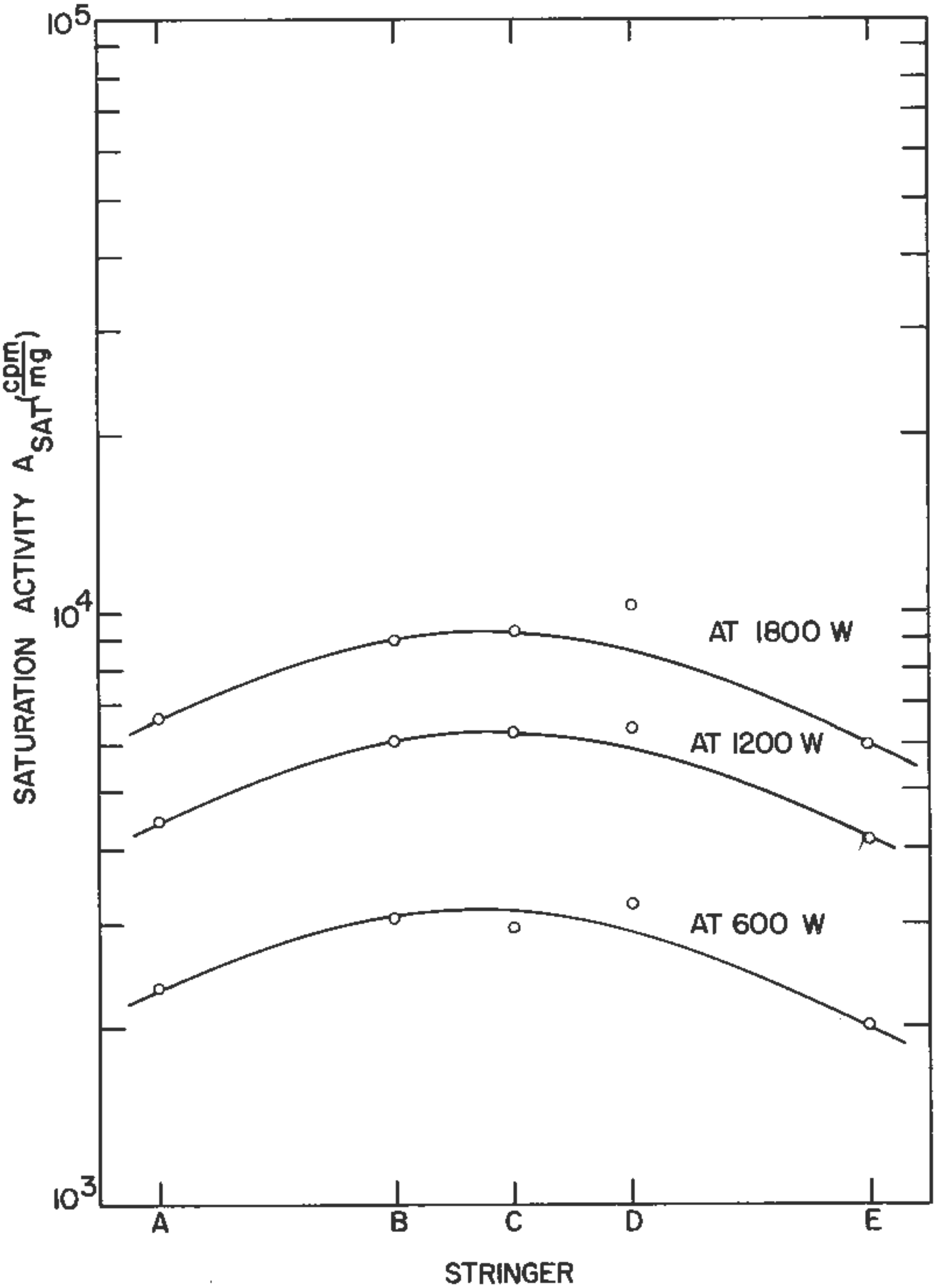


Fig. 32. Saturation activities of cadmium-covered indium foils at Plane 4 across the central stringers of the thermal column

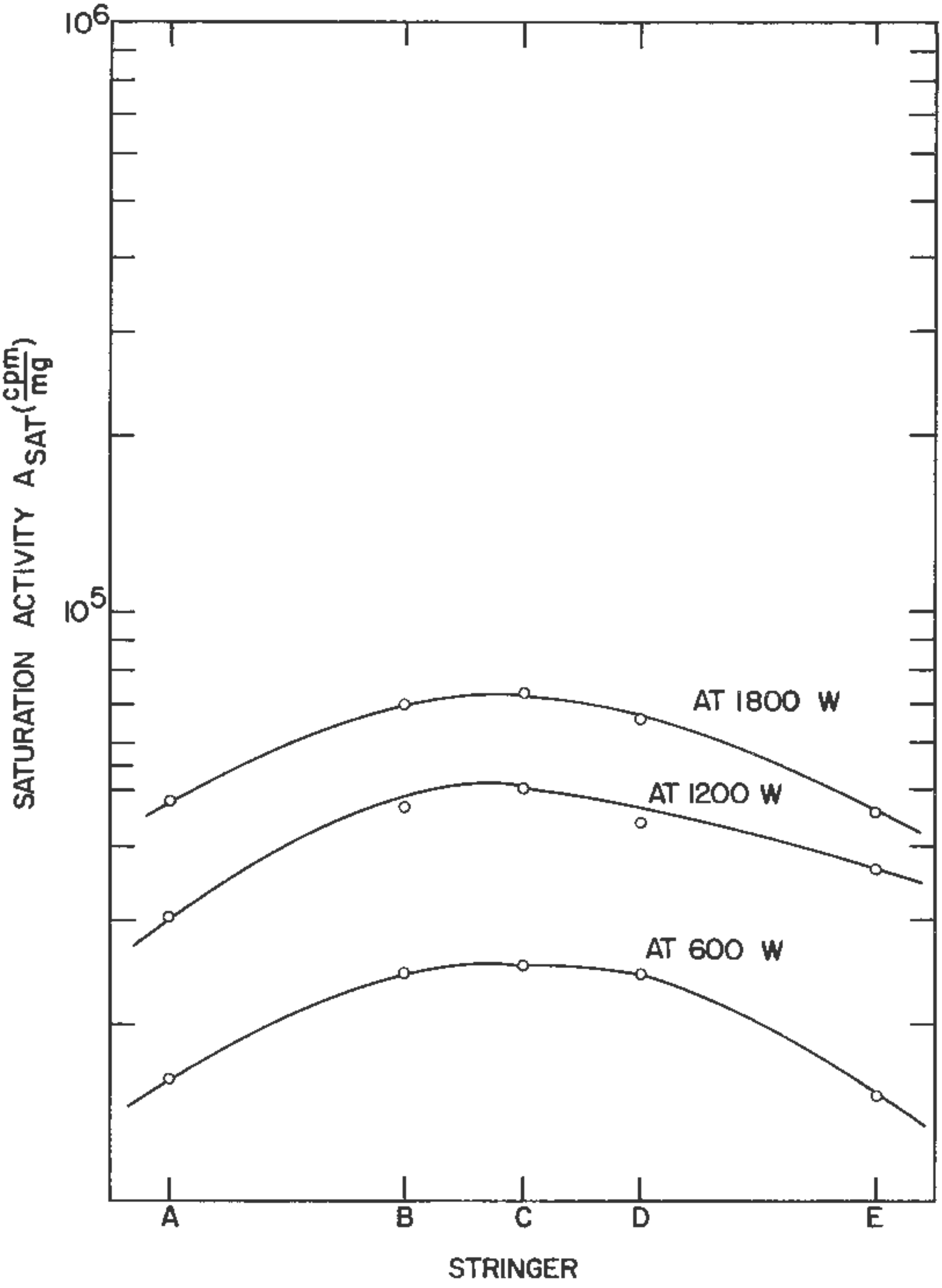


Fig. 33. Saturation activities of cadmium-covered indium foils at Plane 5 across the central stringers of the thermal column

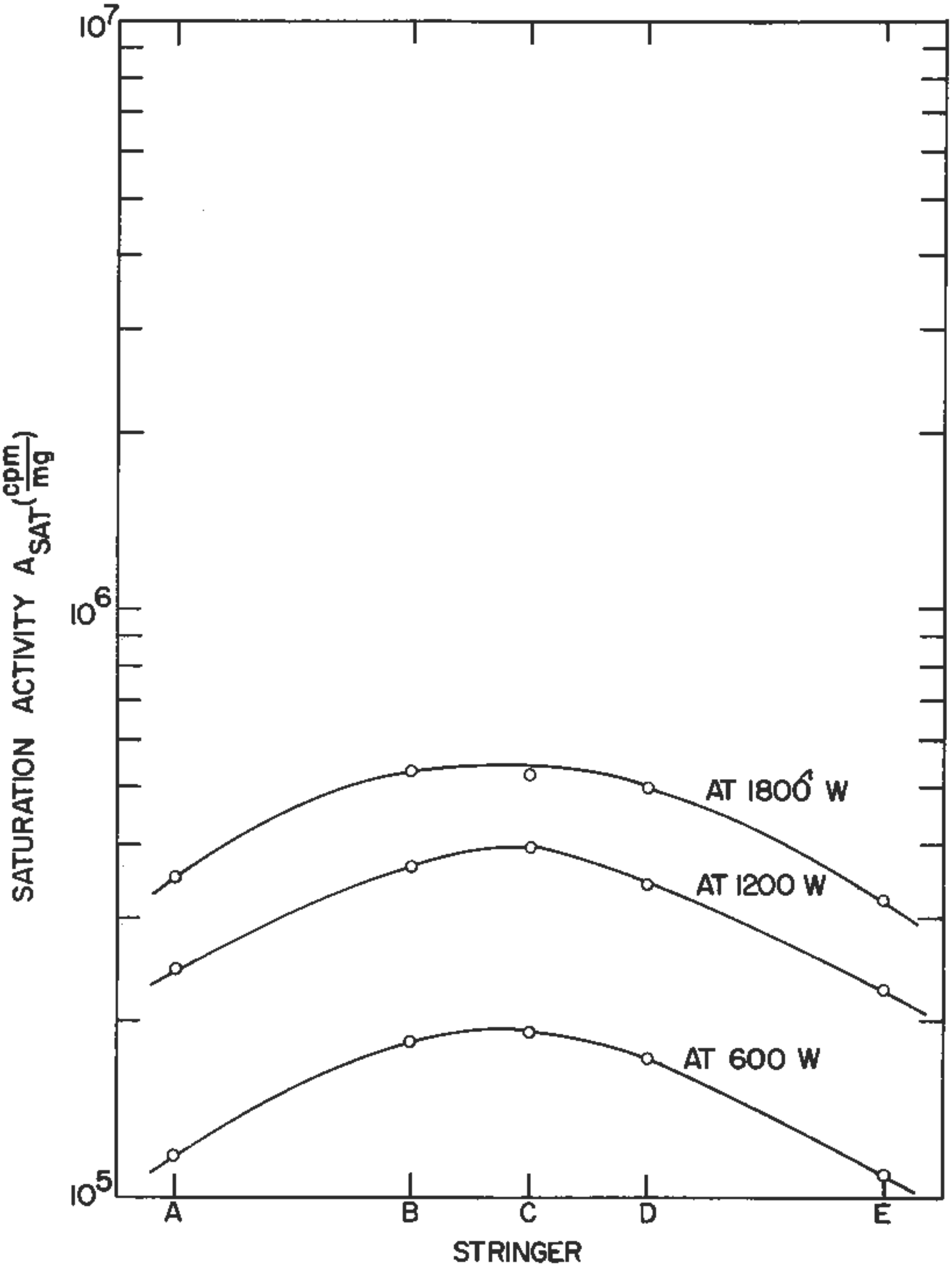


Fig. 34. Saturation activities of cadmium-covered indium foils at Plane 6 across the central stringers of the thermal column

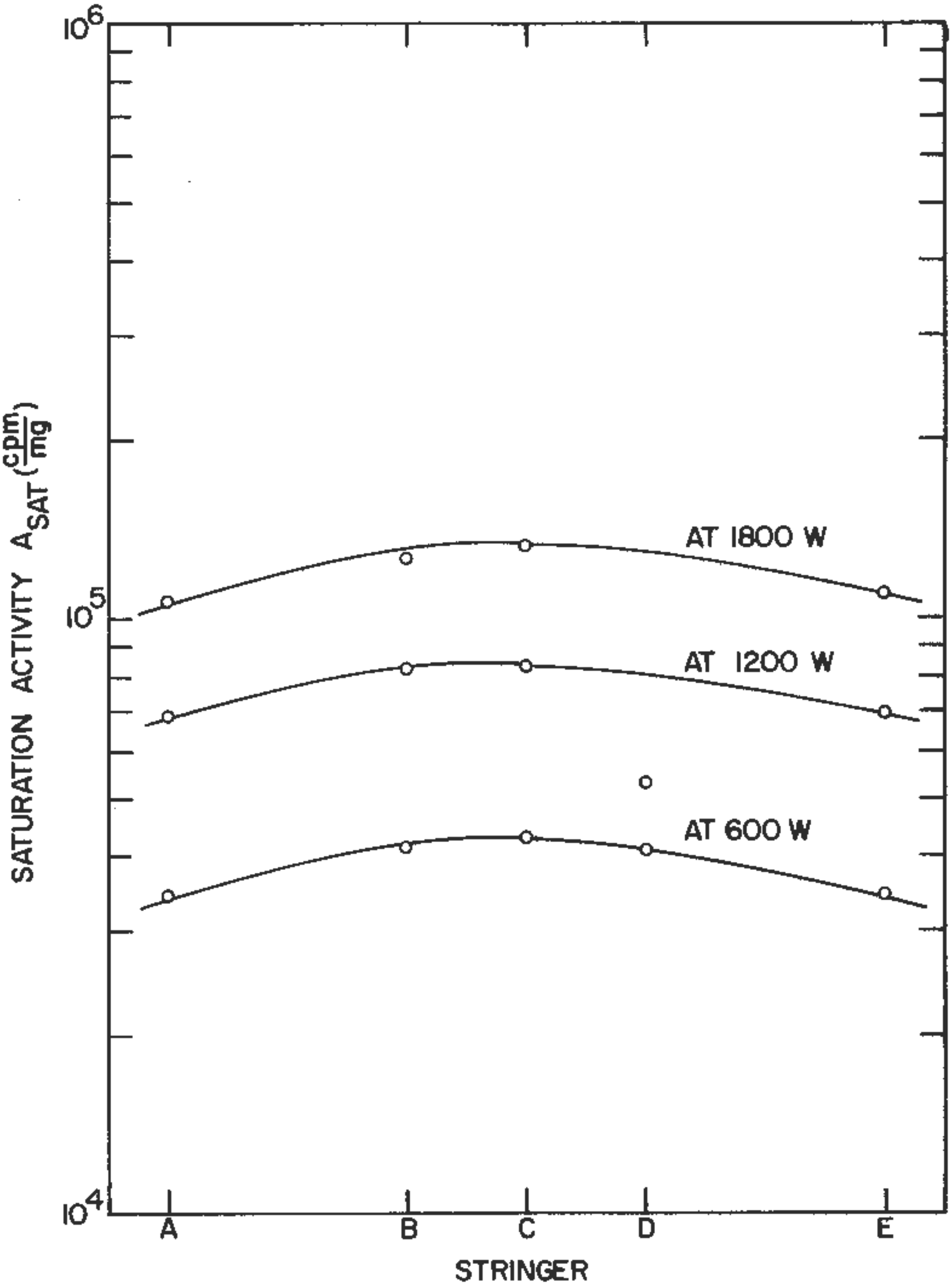


Fig. 35. Saturation activities of bare gold foils at Plane 1 across the central stringers of the thermal column

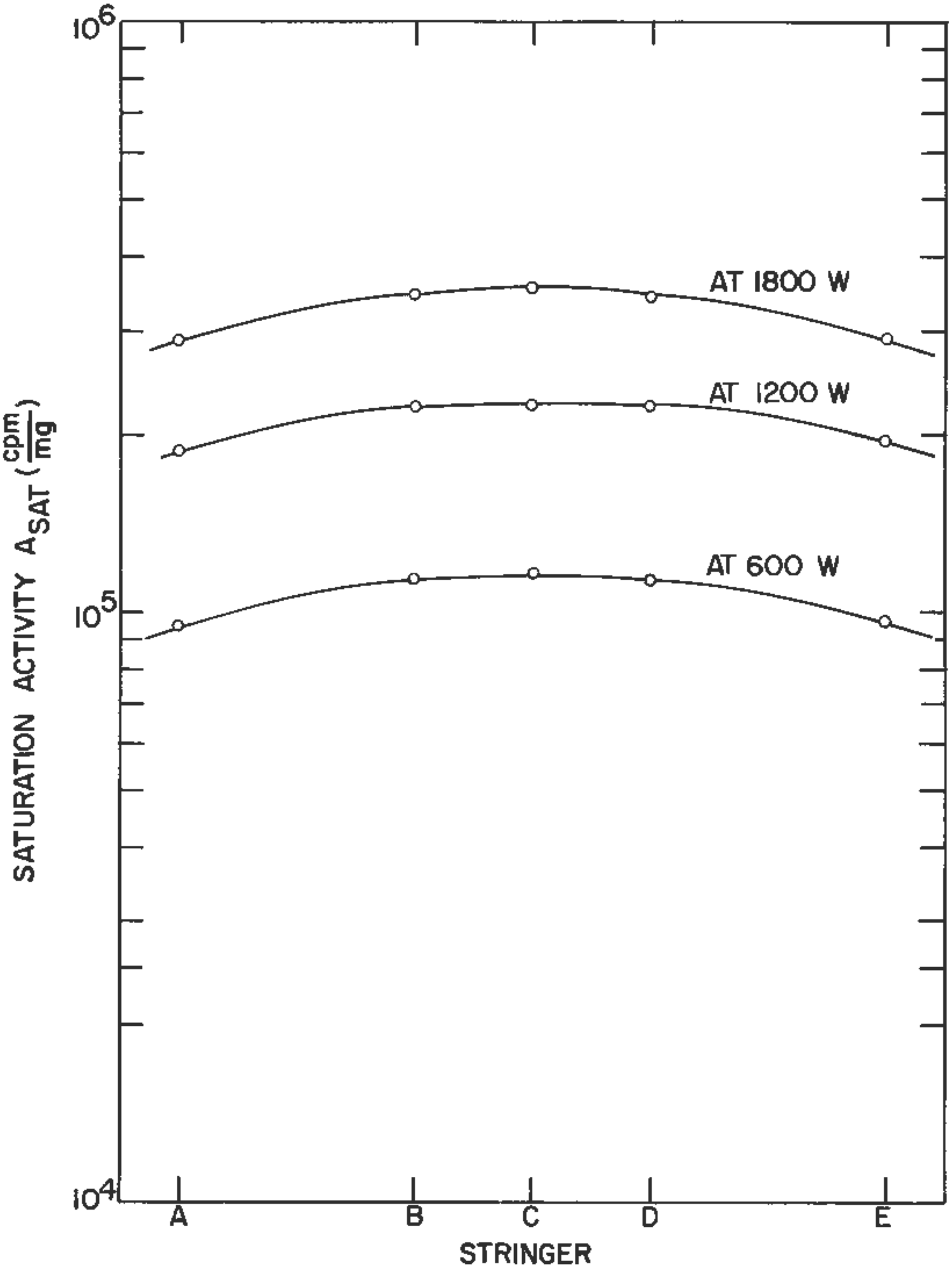


Fig. 36. Saturation activities of bare gold foils at Plane 2 across the central stringers of the thermal column

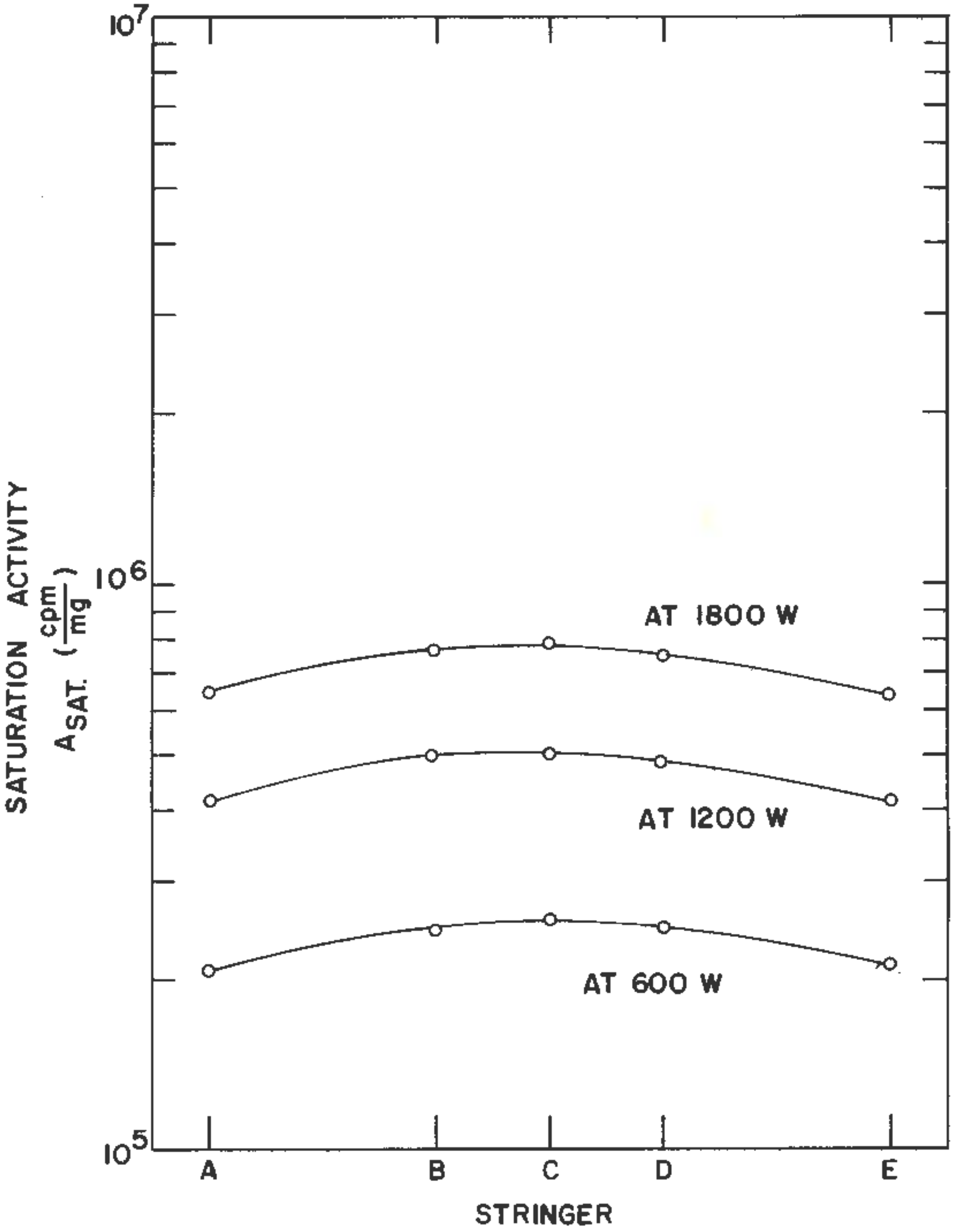


Fig. 37. Saturation activities of bare gold foils at Plane 3 across the central stringers of the thermal column

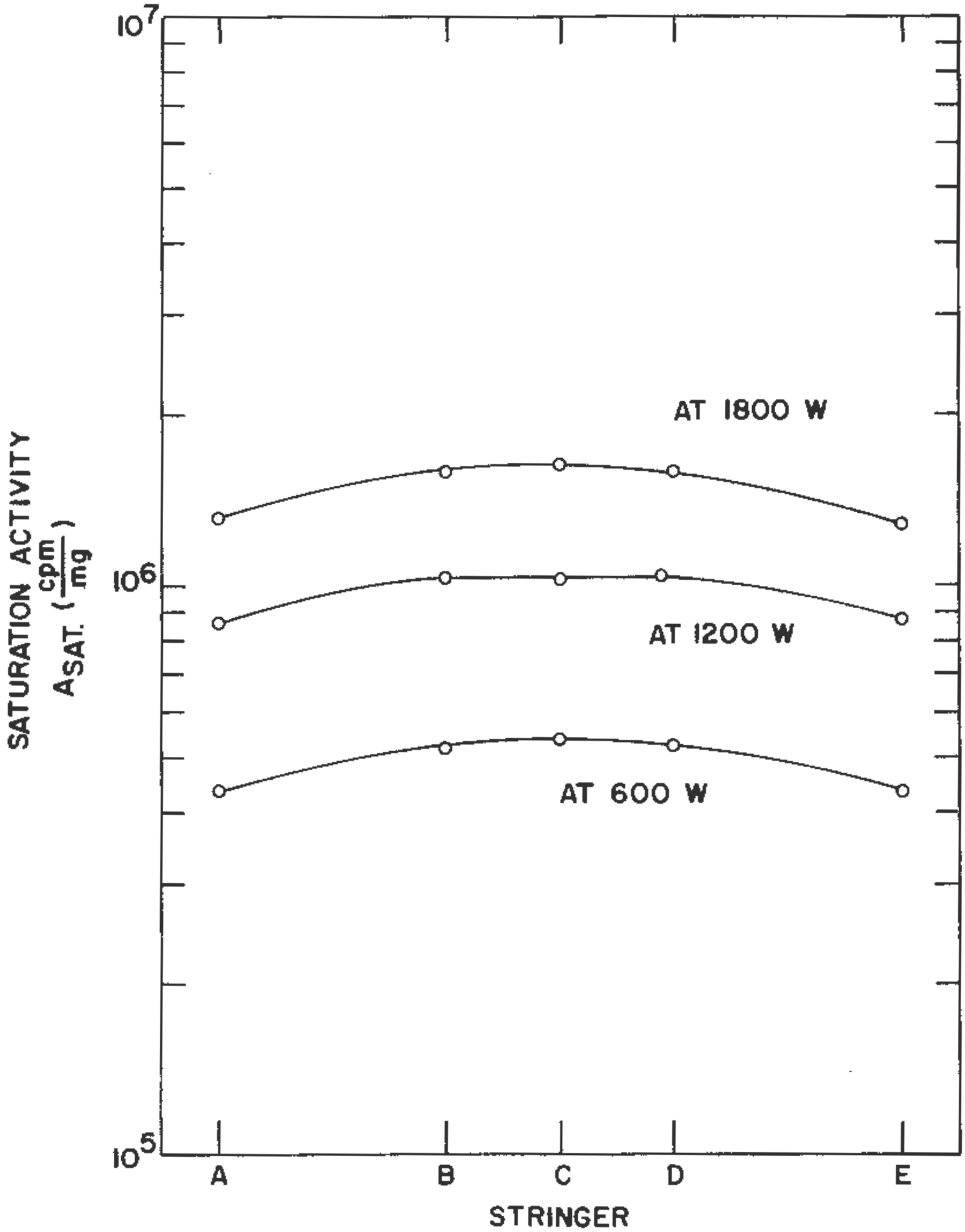


Fig. 38. Saturation activities of bare gold foils at Plane 4 across the central stringers of the thermal column

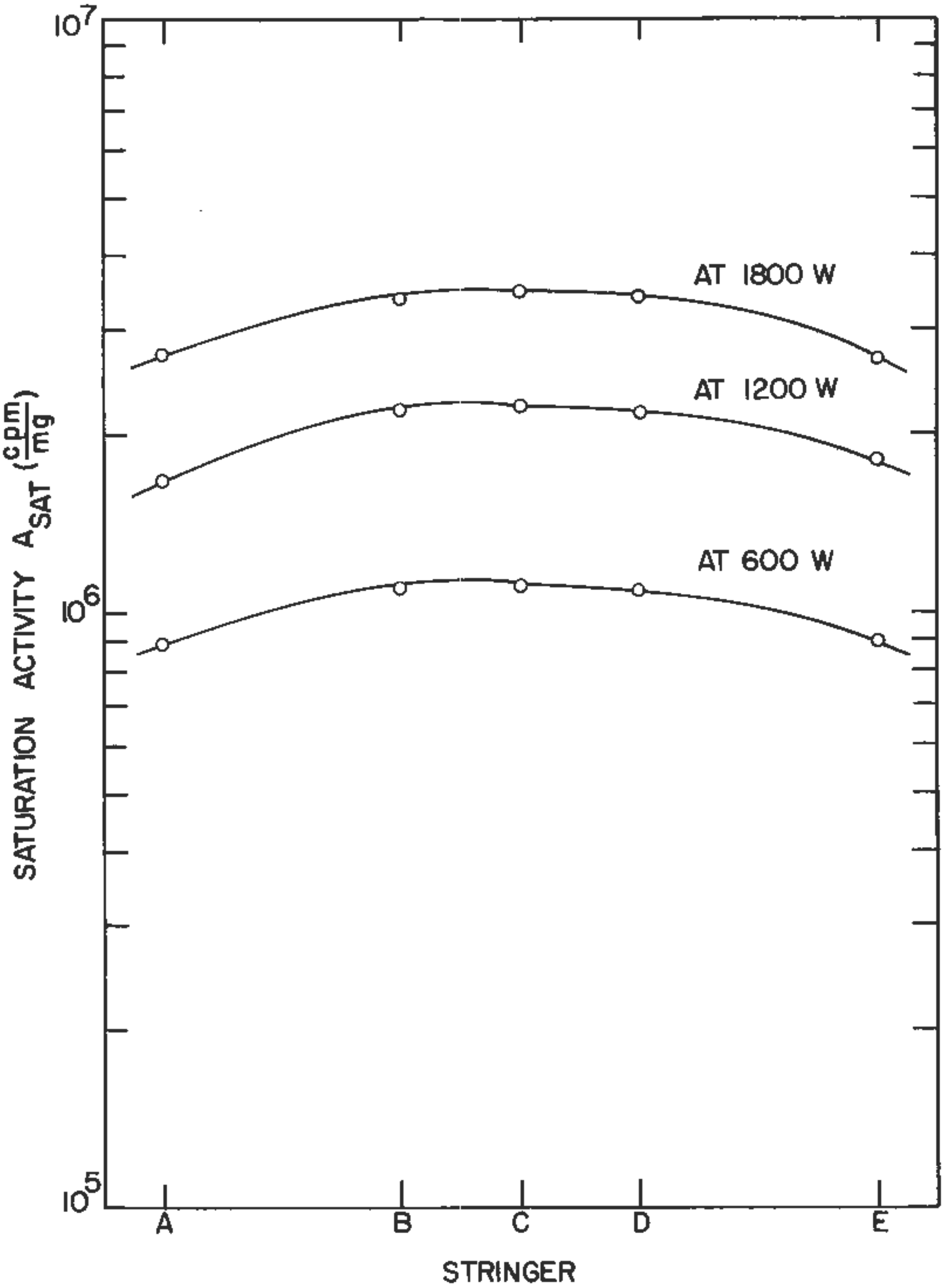


Fig. 39. Saturation activities of bare gold foils at Plane 5 across the central stringers of the thermal column

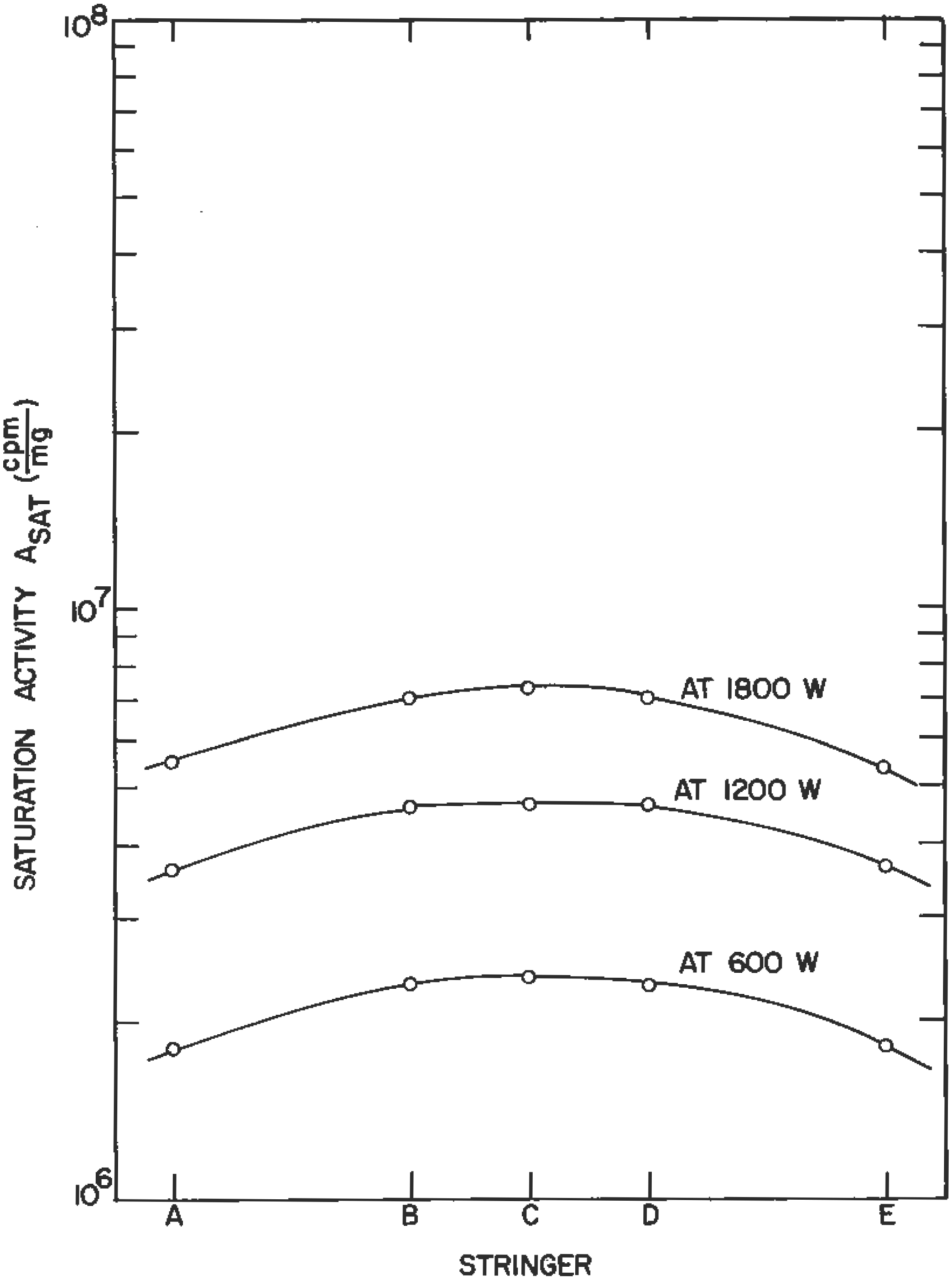


Fig. 40. Saturation activities of bare gold foils at Plane 6 across the central stringers of the thermal column

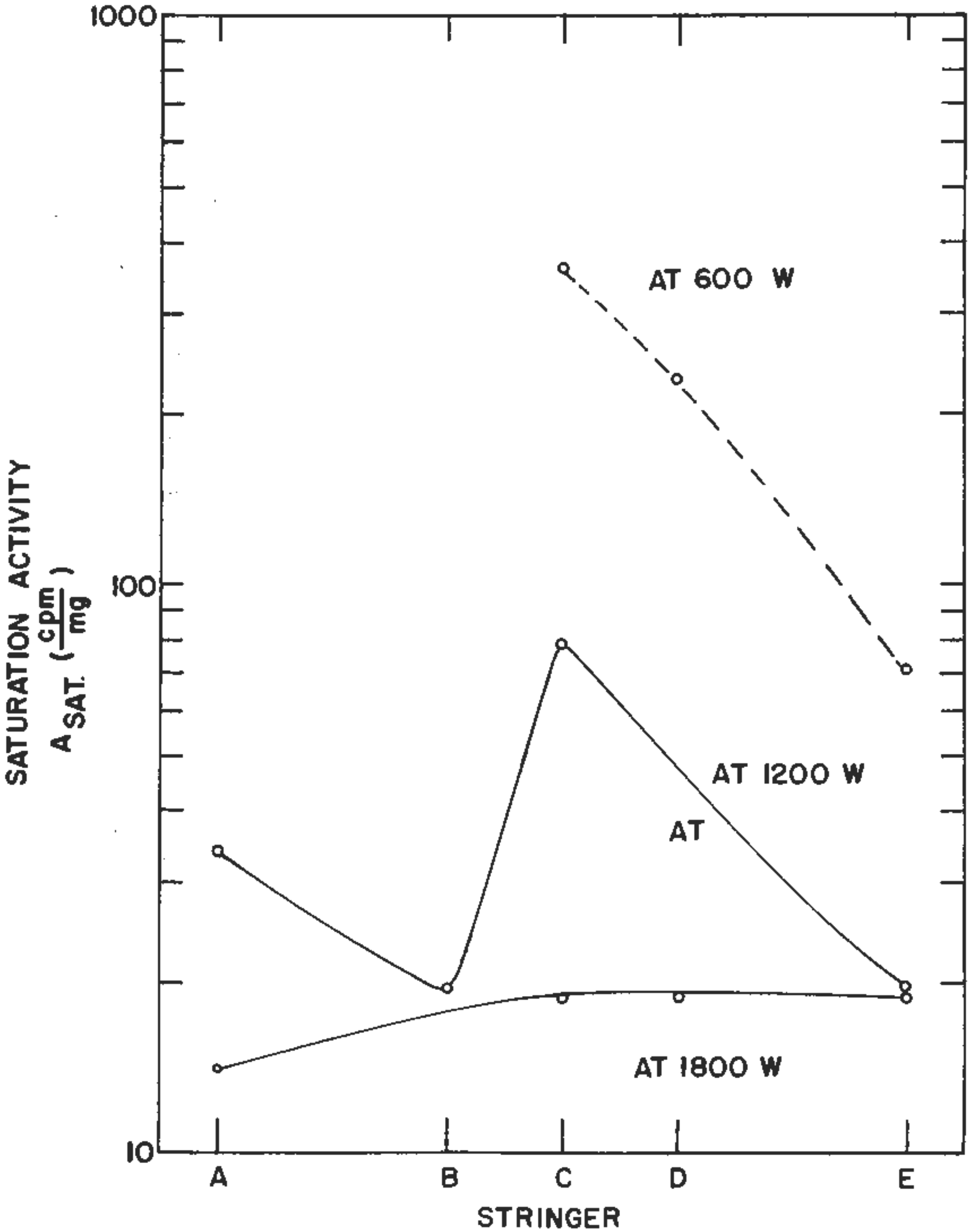


Fig. 41. Saturation activities of cadmium-covered gold foils at Plane 1 across the central stringers of the thermal column

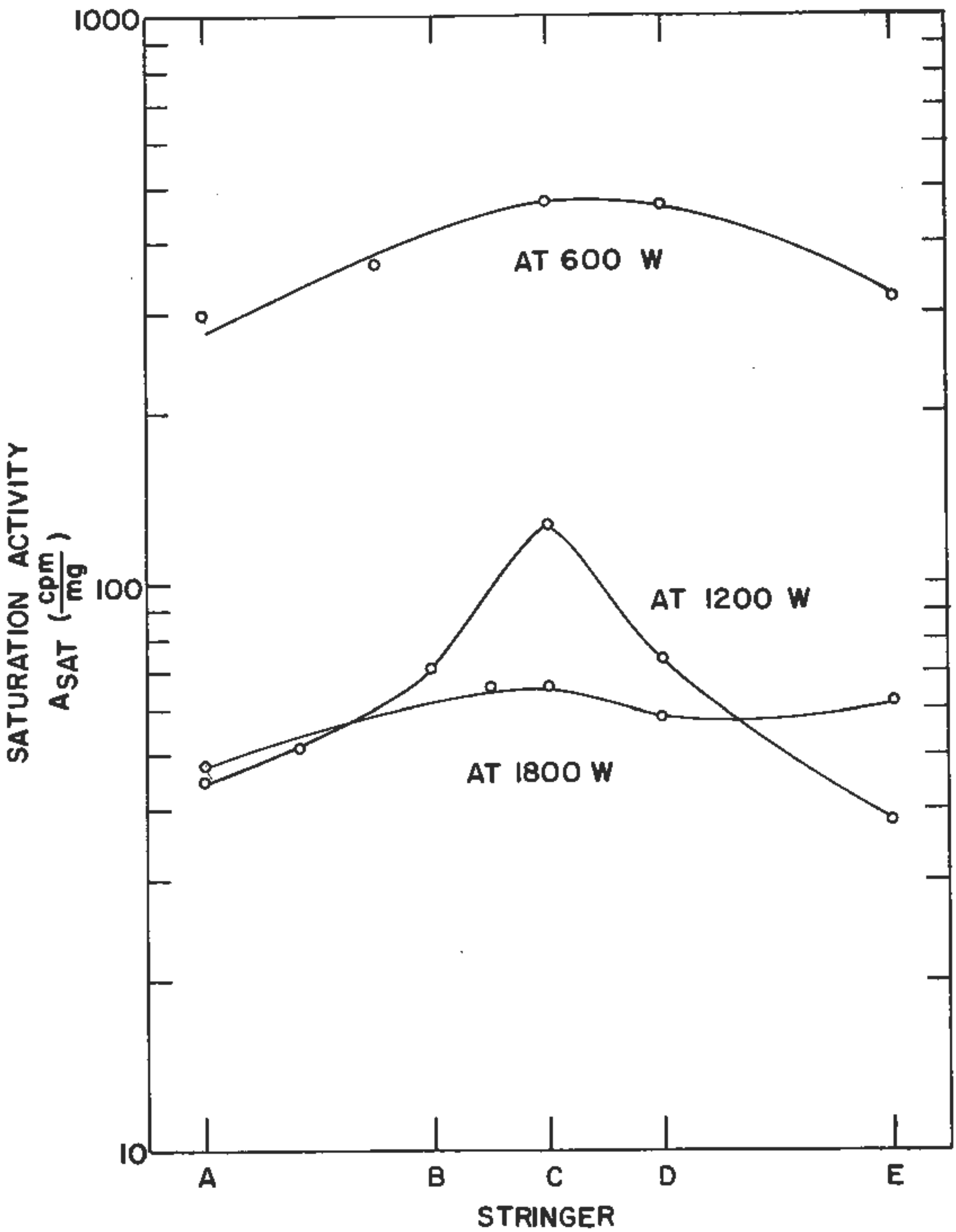


Fig. 42. Saturation activities of cadmium-covered gold foils at Plane 2 across the central stringers of the thermal column

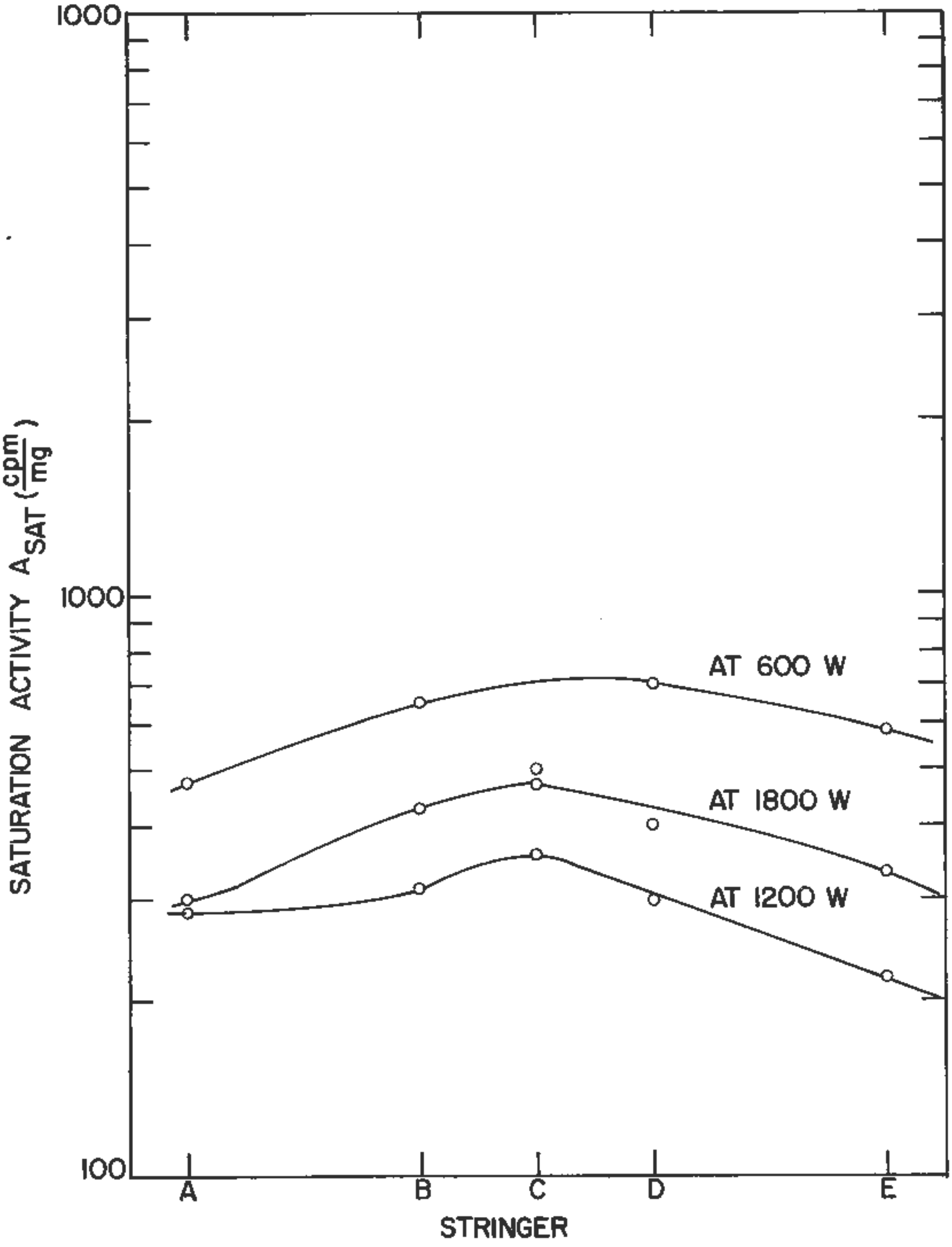


Fig. 43. Saturation activities of cadmium-covered gold foils at Plane 3 across the central stringers of the thermal column

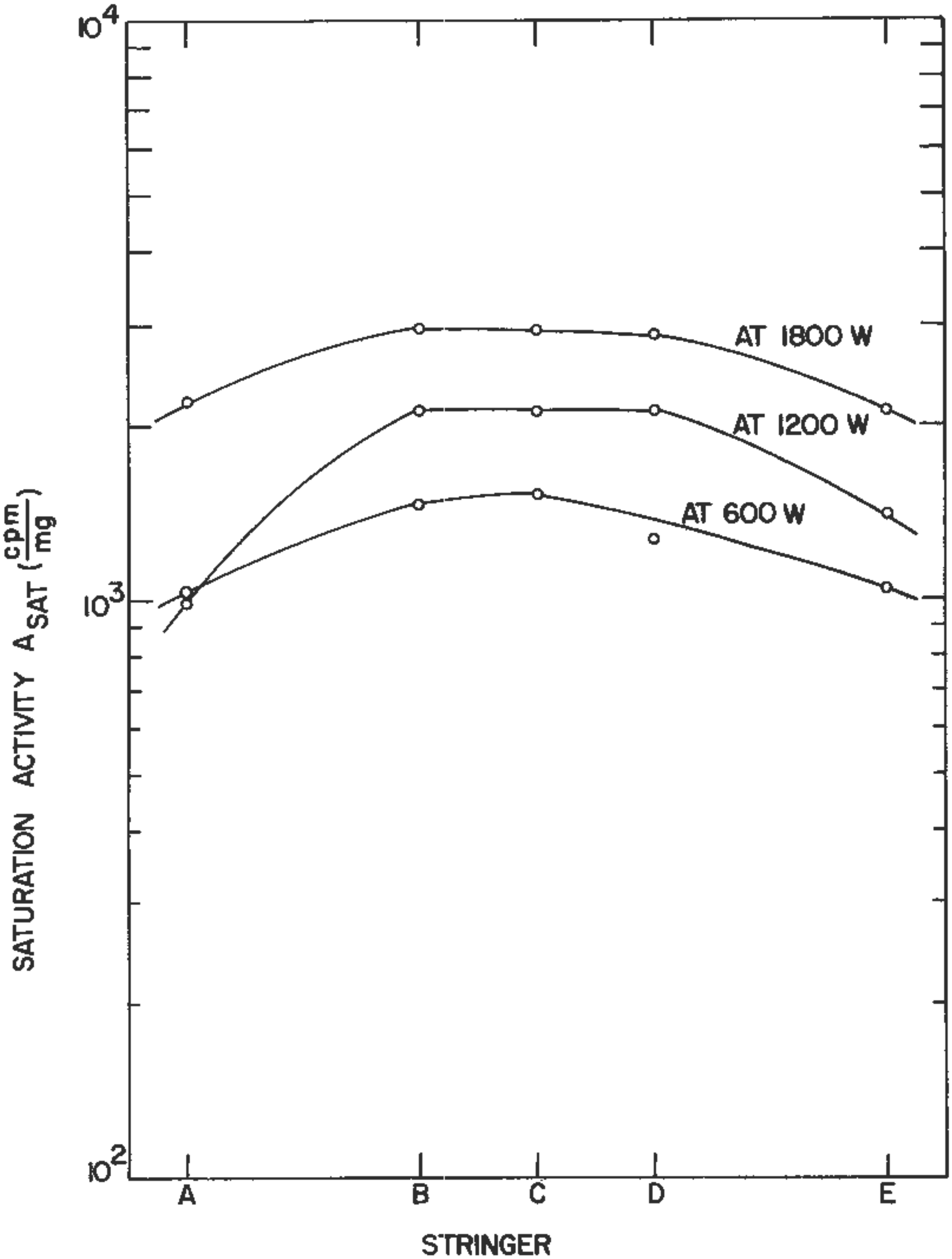


Fig. 44. Saturation activities of cadmium-covered gold foils at Plane 4 across the central stringers of the thermal column

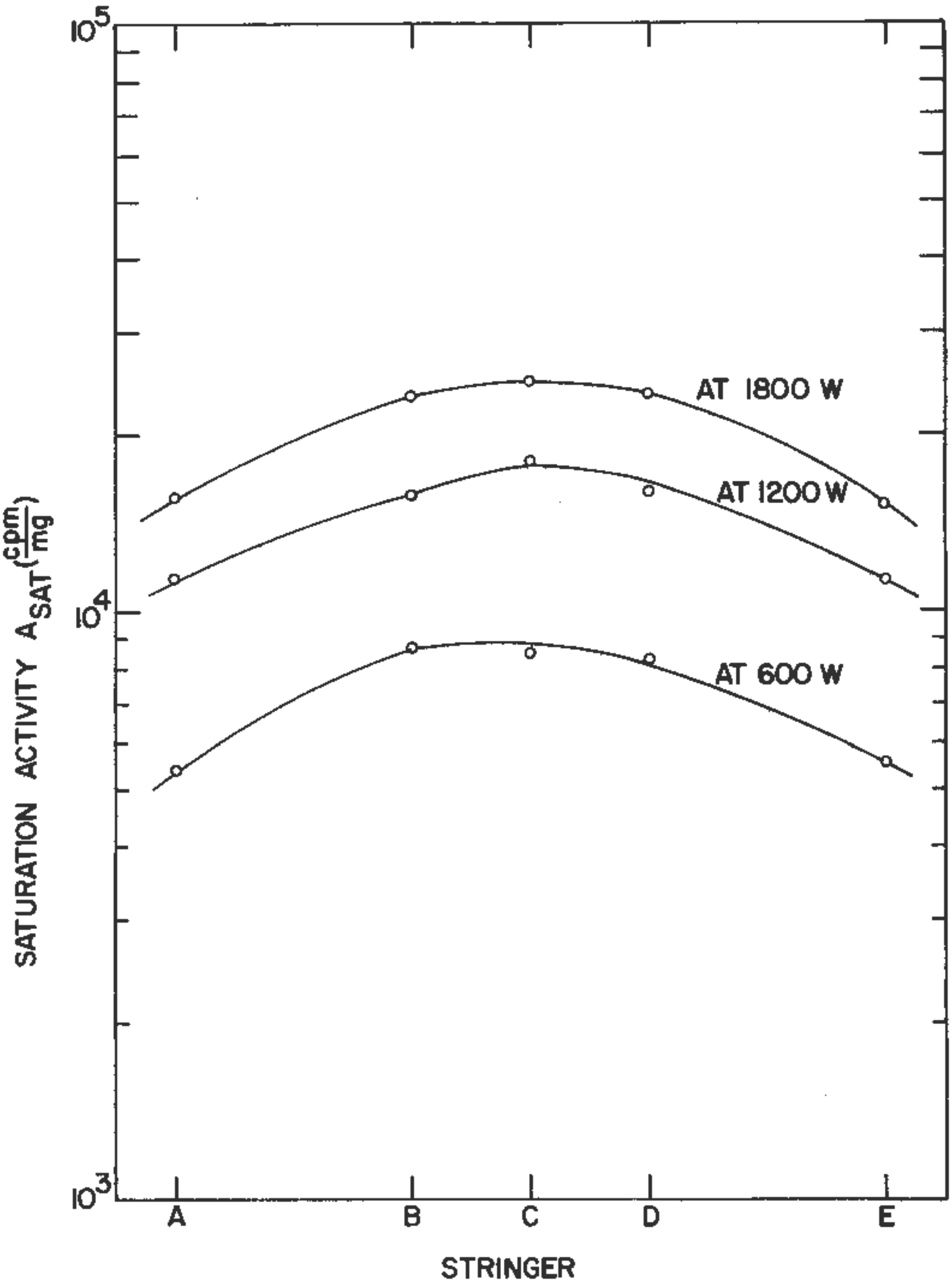


Fig. 45. Saturation activities of cadmium-covered gold foils at Plane 5 across the central stringers of the thermal column

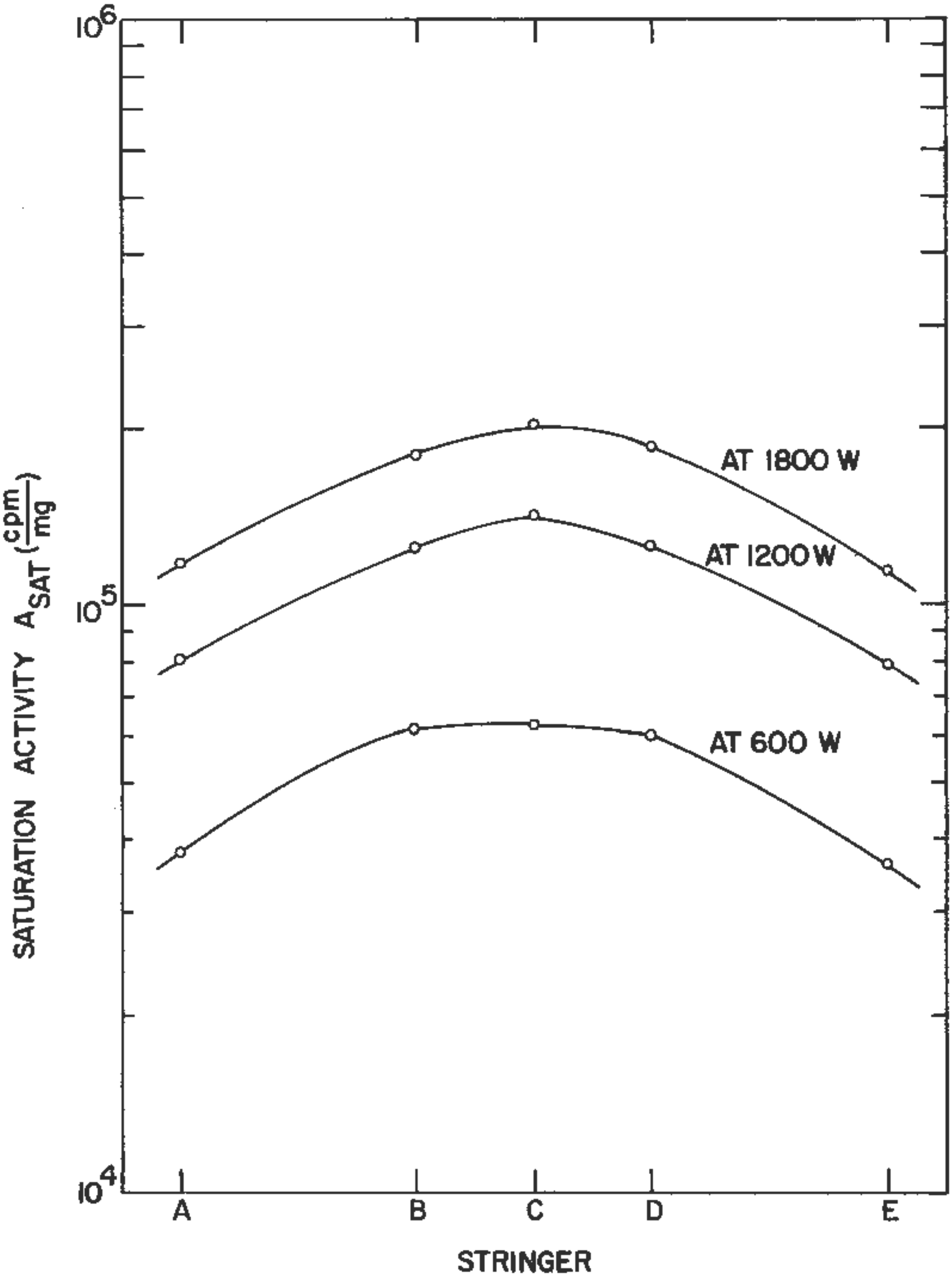


Fig. 46. Saturation activities of cadmium-covered gold foils at Plane 6 across the central stringers of the thermal column

COMMENTS AND RECOMMENDATIONS

The observations of the foils after Run VIII was done while the reactor was at full power (10 kw) for irradiation on another research project. Although the background reading was taken while the reactor was at the full power, it was much too large in comparison with the activities of about half the foils (those in the farthest three planes). Hence the results for cadmium-covered gold foils at 600 watts for planes 1 to 3 came out very high. This run especially should be repeated.

Otherwise, the total and fast neutron profiles are as expected from a reactor of the core configuration as that in the UTR-10. The flux levels at the middle three stringers are nearly the same, with a rapid drop towards the other two side stringers. In the majority of the trials, the activities at saturation in stringer D were found to be slightly less than they would be according to the position on the smoothed out curve. It would be an interesting piece of research to find out the cause of this slight depression in the flux at this line.

Comparison of the experimental curves with the theoretical results, in stringer C (the only one for which theoretical results are available), show a remarkable correlation, especially for the total flux values. The experimental values of the activities for fast flux are lower than the corresponding values indicated by theory, and this may be ascribed to a greater absorption, to a greater thermal neutron impurity at the face of the fuel slab, and to the slightly less height of the actual thermal column then the one for which the theoretical calculations were made.

If the extra trouble would warrant it, the study could be repeated and extended to higher power levels, with provision for counting simultaneously in two or four scalers and counting systems, to increase the accuracy in the regions of low activity. The activations due to flux in the other stringers could also be found similarly, and all these results put together to give an equation expressing the activation at saturation, and hence the flux, in terms of the three position coordinates and the power level at which the reactor is run.

The absolute flux could be determined at one point, and from this the absolute flux at any other point could be calculated.

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APPENDIX

Table 5. Run I

Date: March 18, 1963
Conditions: Indium foils, bare, at 600 watts for 20 min
Reactor scram at 3:44 p.m.
Background count: 146 in 10 min or 15 cpm
Uranium standard: 48,433 in 2 min

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer A:									
1	1	8:02	19,053	2		9,526	9	9,535	9,520
2	3	8:21	41,035	2		20,518	42	20,560	20,545
3	4	8:44	64,267	2		32,134	103	32,237	32,222
4	5	9:17	17,745	2	With absorber #12	8,872	8	8,880	8,865
5	6	9:39	26,693	2	With absorber #12	13,346	18	13,364	13,349
6	7	9:55	44,018	2	With absorber #12	22,009	48	22,057	22,042
Stringer B:									
1	8	8:05	21,760	2		10,880	10	10,890	10,875
2	9	8:31	41,666	2		20,833	43	20,876	20,861
3	10	8:47	74,104	2		37,052	137	37,189	37,174
4	11	9:29	18,000	2	With absorber #12	9,000	8	9,008	8,993
5	12	9:42	31,887	2	With absorber #12	15,944	25	15,969	15,954
6	13	10:02	51,552	2	With absorber #12	25,776	66	25,842	25,827
Stringer C:									
1	14	8:14	19,618	2		9,809	10	9,819	9,804
2	15	8:34	39,824	2		19,912	40	19,952	19,937
3	16	8:53	71,009	2		35,504	126	35,630	35,615
4	17	9:33	16,854	2	With absorber #12	8,427	7	8,434	8,419
5	18	9:48	29,179	2	With absorber #12	14,590	21	14,611	14,596
6	19	10:08	48,666	2	With absorber #12	24,333	59	24,392	24,377
7	32	7:44	146,076	2	With absorber #13	73,038	533	73,571	73,556

Uranium standard: 48,690 in 2 min
Background: 157 in 10 min or 16 cpm

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer D:									
1	22	8:11	19,360	2		9,680	9	9,689	9,674
2	23	8:27	43,032	2		21,516	46	21,562	21,547
3	24	8:50	71,510	2		35,755	128	35,883	35,868
4	25	9:20	20,137	2	With absorber #12	10,068	10	10,078	10,063
5	26	9:45	29,310	2	With absorber #12	14,655	22	14,677	14,662
6	27	10:05	50,713	2	With absorber #12	25,356	64	25,420	25,405
Stringer E:									
1	28	8:08	17,889	2		8,944	8	8,952	8,937
2	29	8:24	40,018	2		20,009	40	20,049	20,034
3	30	8:41	69,852	2		34,926	122	35,048	35,033
4	31	9:10	19,659	2	With absorber #12	9,830	10	9,840	9,825
5	36	9:36	29,322	2	With absorber #12	14,661	22	14,683	14,668
6	33	9:58	44,802	2	With absorber #12	22,401	50	22,451	22,436
For calculation of absorber factor:									
	16	9:00	65,457	2	No absorber	32,728	107	32,835	32,820
		9:03	12,109	2	With absorber #12	6,054	4	6,058	6,043

Table 5 (continued)

Absorber factor: for No. 12 = 5.226 (from Table 17)
for No. 13 = --

t_e = 20 min

$1 - e^{-\lambda t_e}$ = 0.22642

F_c = 1.0000 (from Table 18)

F_p = 1.0000 (from Table 19b)

Position	Foil No.	Net cpm	True net cpm	Foil wt (mg)	$\frac{cpm}{mg}$	t_w	$e^{-\lambda t_w}$	F	A_{sat} $\frac{cpm}{mg}$
Stringer A:									
1	1	9,520	9,520	11.22	849	4h 19m	0.03599	122.7	1.041×10^5
2	3	20,545	20,545	11.01	1,866	4h 38m	0.02817	156.8	2.957×10^5
3	4	32,222	32,222	10.65	3,026	5h 01m	0.02099	210.4	6.366×10^5
4	5	8,865	46,330	11.05	4,193	5h 34m	0.01374	321.4	1.347×10^6
5	6	13,349	69,760	11.14	6,262	5h 56m	0.01036	426.2	2.669×10^6
6	7	22,042	115,200	10.83	10,640	6h 12m	0.008438	523.4	5.567×10^6
Stringer B:									
1	8	10,875	10,875	11.22	969	4h 22m	0.03463	127.5	1.236×10^5
2	9	20,861	20,861	10.78	1,935	4h 48m	0.02480	178.1	3.446×10^5
3	10	37,174	37,174	11.03	3,370	5h 04m	0.02020	218.7	7.370×10^5
4	11	8,993	47,000	10.99	4,276	5h 46m	0.01178	374.9	1.603×10^6
5	12	15,954	83,370	10.99	7,586	5h 59m	0.009971	443.0	3.360×10^6
6	13	25,827	135,000	10.80	12,500	6h 19m	0.007713	572.6	7.156×10^6
Stringer C:									
1	14	9,804	9,804	10.96	895	4h 31m	0.03085	143.2	1.281×10^5
2	15	19,937	19,937	10.66	1,870	4h 51m	0.02387	185.1	3.461×10^5
3	16	35,615	35,615	11.12	3,203	5h 10m	0.01870	236.2	7.564×10^5
4	17	8,419	44,000	10.67	4,123	5h 50m	0.01119	394.6	1.627×10^6
5	18	14,596	76,270	10.57	7,216	6h 05m	0.009231	478.4	3.452×10^6
6	19	24,377	127,400	10.90	11,690	6h 25m	0.007141	618.5	7.228×10^6
7	32	73,556							
Stringer D:									
1	22	9,674	9,674	10.82	894	4h 28m	0.03206	137.7	1.232×10^5
2	23	21,547	21,547	10.99	1,961	4h 44m	0.02611	169.2	3.317×10^5
3	24	35,868	35,868	10.66	3,365	5h 07m	0.01944	227.2	7.646×10^5
4	25	10,063	52,590	11.41	4,609	5h 37m	0.01322	334.0	1.539×10^6
5	26	14,662	76,620	11.45	6,691	6h 02m	0.009594	460.4	3.090×10^6
6	27	25,405	132,800	11.54	11,500	6h 22m	0.007422	595.1	6.846×10^6
Stringer E:									
1	28	8,937	8,937	11.61	770	4h 25m	0.03332	132.5	1.020×10^5
2	29	20,034	20,034	11.80	1,698	4h 41m	0.02714	162.8	2.763×10^5
3	30	35,033	35,033	11.76	2,979	4h 58m	0.02182	202.5	6.031×10^5
4	31	9,825	51,340	11.73	4,377	5h 27m	0.01504	293.8	1.286×10^6
5	36	14,668	76,650	11.79	6,507	5h 53m	0.01077	410.1	2.679×10^6
6	33	22,436	117,200	11.67	10,050	6h 15m	0.008119	544.0	5.465×10^6
For calculation of absorber factor:									
	16	32,820							
		6,043							

Table 6. Run II

Date: April 1, 1963
Conditions: Indium foils, cadmium-covered, at 600 watts for 20 min
Reactor scram at 4:12 p.m.
Background count: 163 in 10 min or 16 cpm
Uranium standard: 48,523 in 2 min

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer A:									
1	37	4:39	84	2		42	-	42	26
2	3	4:59	218	2		109	-	109	93
3	4	5:12	797	2		398	-	398	382
4	5	5:27.5	4,289	2		2,144	-	2,144	2,128
5	6	5:43.5	24,359	2		12,180	15	12,195	12,179
6	7	5:54	150,093	2		75,046	563	75,609	75,593
		6:03	25,706	2	With absorber #12	12,853	16	12,869	12,853
Stringer B:									
1	8	4:50	80	2		40	-	40	24
2	9	5:04.5	261	2		130	-	130	114
3	10	5:17	1,034	2		517	-	517	501
4	11	5:30	5,448	2		2,724	1	2,725	2,709
5	12	5:49	33,937	2		16,968	29	16,997	16,981
6	13	6:05.5	38,837	2	With absorber #12	19,418	38	19,456	19,440
Stringer C:									
1	14	4:53	92	2		46	-	46	30
2	15	5:07	254	2		127	-	127	111
3	16	5:22	913	2		456	-	456	440
4	35	5:35	5,183	2		2,592	1	2,593	2,577
5	18	5:51.5	32,167	2		16,084	26	16,110	16,094
6	19	6:10.5	37,816	2	With absorber #12	18,908	36	18,944	18,928
7	34	8:06	149,569	2	With absorber #13	74,785	559	75,344	75,326

Uranium standard: 48,407 in 2 min
Background: 182 in 10 min or 18 cpm

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer D:									
1	20	4:46.5	95	2		48	-	48	32
2	38	5:02	235	2		118	-	118	102
3	22	5:19.5	931	2		466	-	466	450
4	35	5:32.5	5,865	2		2,932	1	2,933	2,917
5	24	5:46.5	33,404	2		16,702	28	16,730	16,714
6	25	6:08	37,286	2	With absorber #12	18,643	35	18,678	18,662
Stringer E:									
1	26	4:42.5	93	2		46	-	46	30
2	27	4:56	242	2		121	-	121	105
3	36	5:14.5	747	2		374	-	374	358
4	29	5:25	4,104	2		2,052	-	2,052	2,036
5	30	5:41	24,775	2		12,388	15	12,403	12,387
6	31	5:57	144,591	2		72,296	523	72,819	72,803

Table 6 (continued)

Absorber factor: for No. 12 = 5.240 (from Table 17)
for No. 13 = --

t_e = 20 min

$1 - e^{-\lambda t_e} = 0.22642$

F_c = 0.99821 (from Table 18)

F_p = 1.0217 (from Table 19b)

Position	Foil No.	Net cpm	True net cpm	Foil wt (mg)	$\frac{cpm}{mg}$	t_w	$e^{-\lambda t_w}$	F	A_{sat} $\frac{cpm}{mg}$
Stringer A:									
1	37	26	26	11.61	2.2	0h 28m	0.6981	6.45	14.3
2	3	93	93	11.01	8.4	0h 48m	0.5400	8.34	70.3
3	4	382	382	10.65	35.9	1h 01m	0.4570	9.86	354
4	5	2,128	2,128	11.05	193	1h 16.5m	0.3746	12.03	2,317
5	6	12,179	12,179	11.14	1,093	1h 32.5m	0.3050	14.77	17,040
6	7	75,593	75,593	10.83	6,980	1h 43m	0.2666	16.90	117,900
		12,853							
Stringer B:									
1	8	24	24	11.22	2.1	0h 39m	0.6062	7.43	15.7
2	9	114	114	10.78	10.6	0h 53.5m	0.5032	8.23	87.2
3	10	501	501	11.03	45.4	1h 06m	0.4286	10.51	477
4	11	2,709	2,709	10.99	246	1h 19m	0.3627	12.42	3,060
5	12	16,981	16,981	10.99	1,545	1h 38m	0.2842	15.85	24,490
6	13	19,440	101,900	10.80	9,431	1h 54.5m	0.2300	19.59	184,700
Stringer C:									
1	14	30	30	10.96	2.7	0h 42m	0.5833	7.72	20.9
2	15	111	111	10.66	10.4	0h 56m	0.4873	9.24	96.0
3	16	440	440	11.12	39.6	1h 11m	0.4020	11.21	444
4	45	2,577	2,577	11.63	221	1h 24m	0.3402	13.24	2,930
5	18	16,094	16,094	10.57	1,523	1h 40.5m	0.2755	16.56	24,920
6	19	18,928	99,170	10.90	9,098	1h 59.5m	0.2157	20.88	190,000
7	34	75,326							
Stringer D:									
1	20	32	32	10.76	2.9	0h 35.5m	0.6340	7.10	20.6
2	38	102	102	11.83	8.6	0h 51m	0.5196	8.67	74.2
3	22	450	450	10.82	41.5	1h 8.5m	0.4151	10.85	451
4	35	2,917	2,917	11.64	251	1h 21.5m	0.3513	12.82	3,213
5	24	16,714	16,714	10.66	1,568	1h 35.5m	0.2935	15.35	24,060
6	25	18,662	97,780	11.41	8,570	1h 57m	0.2227	20.22	173,300
Stringer E:									
1	26	30	30	11.45	2.6	0h 31.5m	0.6674	6.75	17.8
2	27	105	105	11.54	9.1	0h 45m	0.5612	8.03	72.8
3	36	358	358	11.61	30.8	1h 3.5m	0.4426	10.18	313
4	29	2,036	2,036	11.80	173	1h 14m	0.3868	11.65	2,009
5	30	12,387	12,387	11.76	1,053	1h 30m	0.3150	14.30	15,060
6	31	72,803	72,803	11.73	6,206	1h 46m	0.2565	17.56	109,000

Table 7. Run III

Date: April 16, 1963
Conditions: Indium foils, bare, at 1200 watts for 10 min
Reactor scram at 10:59 a.m.
Background count: 180 in 10 min or 18 cpm
Uranium standard: 47,979 in 2 min

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer A:									
1	4	2:49	28,077	2		14,038	20	14,058	14,040
2	5	3:04	65,279	2		32,640	106	32,746	32,728
3	6	3:22	21,798	2	With absorber #12	10,989	12	11,001	10,983
4	7	3:37	36,906	2	With absorber #12	18,453	34	18,487	18,469
5	8	3:58	59,706	2	With absorber #12	29,853	89	29,942	29,924
6	9	4:16	34,482	2	With absorbers #12 and #13	17,241	30	17,271	17,253
Stringer B:									
1	10	2:58	30,082	2		15,041	23	15,064	15,046
2	11	3:13	67,126	2		33,563	113	33,676	33,658
3	12	3:31	22,531	2	With absorber #12	11,266	13	11,279	11,261
4	13	3:46	39,123	2	With absorber #12	19,562	38	19,600	19,582
5	14	4:07	64,563	2	With absorber #12	32,282	114	32,396	32,378
		4:10	22,656	2	With absorbers #12 and #13	11,328	13	11,341	11,323
6	15	4:25	38,086	2	With absorbers #12 and #13	19,043	36	19,079	19,061
Stringer C:									
1	16	3:01	30,087	2		15,044	23	15,067	15,049
2	18	3:16	64,812	2		32,406	105	32,511	32,493
		3:19	11,856	2	With absorber #12	5,928	4	5,932	5,914
3	19	3:34	22,201	2	With absorber #12	11,100	12	11,112	11,094
4	20	3:52	37,060	2	With absorber #12	18,530	34	18,564	18,546
5	22	4:13	60,057	2	With absorber #12	30,028	90	30,118	30,100
6	24	4:28	37,908	2	With absorbers #12 and #13	18,954	36	18,990	18,972
7	26	4:31	47,135	2	With absorber #13	23,568	56	23,624	23,605

Uranium standard: 48,663 in 2 min
Background: 186 in 10 min or 19 cpm

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer D:									
1	27	2:55	31,607	2		15,804	25	15,829	15,811
2	29	3:10	72,483	2		36,242	131	36,373	36,355
3	30	3:28	25,240	2	With absorber #12	12,620	16	12,636	12,618
4	31	3:55	37,466	2	With absorber #12	18,733	35	18,768	18,750
5	32	4:04	69,962	2	With absorber #12	34,981	122	35,103	35,085
6	33	4:22	41,147	2	With absorbers #12 and #13	20,574	42	20,616	20,598
Stringer E:									
1	34	2:52	28,731	2		14,366	21	14,387	14,369
2	35	3:07	64,365	2		32,182	104	32,286	32,268
3	36	3:25	22,083	2	With absorber #12	11,042	12	11,054	11,036
4	37	3:40	36,985	2	With absorber #12	18,492	34	18,526	18,508
5	38	4:01	58,706	2	With absorber #12	29,353	86	29,439	29,421
6	40	4:19	35,738	2	With absorbers #12 and #13	17,869	32	17,901	17,883

Table 7 (continued)

Absorber factor: for No. 12 = 5.287 (from Table 17)
for No. 13 = 2.752

t_e = 10 min

$1 - e^{-\lambda t_e} = 0.12046$

F_e = 1.0096 (from Table 18)

F_p = 0.98879 (from Table 19b)

Position	Foil No.	Net cpm	True net cpm	Foil wt (mg)	$\frac{cpm}{mg}$	t_w	$e^{-\lambda t_w}$	F	A_{sat} $\frac{cpm}{mg}$
Stringer A:									
1	4	14,040	14,040	10.65	1,318	3h 51m	0.05155	160.7	2.119x10^5
2	5	32,728	32,728	11.05	2,962	4h 06m	0.04253	194.9	5.772x10^5
3	6	10,983	58,070	11.14	5,213	4h 24m	0.03375	245.5	1.280x10^6
4	7	18,469	97,650	10.83	9,016	4h 39m	0.02784	297.7	2.684x10^6
5	8	29,924	158,200	11.22	14,100	4h 59m	0.02154	384.8	5.387x10^6
6	9	17,253	251,000	10.78	23,280	5h 18m	0.01688	491.1	1.143x10^7
Stringer B:									
1	10	15,046	15,046	11.03	1,364	4h 0m	0.04593	180.4	2.461x10^5
2	11	33,658	33,658	10.99	3,063	4h 15m	0.03789	218.7	6.699x10^5
3	12	11,261	59,530	10.99	5,417	4h 33m	0.03007	275.6	1.493x10^6
4	13	19,582	103,000	10.80	9,586	4h 47m	0.02512	329.9	3.162x10^6
5	14	32,378	171,200	10.96	15,620	5h 09m	0.01894	437.5	6.833x10^6
		11,323							
6	15	19,061	277,300	10.66	26,010	5h 27m	0.01504	551.2	1.434x10^7
Stringer C:									
1	16	15,049	15,049	11.12	1,353	4h 03m	0.04419	187.5	2.538x10^5
2	18	32,493	32,493	10.57	3,074	4h 18m	0.03645	227.3	6.988x10^5
		5,914							
3	19	11,094	58,660	10.90	5,382	4h 36m	0.02893	286.4	1.541x10^6
4	20	18,546	98,060	10.76	9,113	4h 54m	0.02297	360.9	3.289x10^6
5	22	30,100	159,100	10.82	14,710	5h 15m	0.01754	472.5	6.950x10^6
6	24	18,972	276,000	10.66	25,890	5h 30m	0.01447	572.8	1.483x10^7
7	26	23,605							
Stringer D:									
1	27	15,811	15,811	11.54	1,370	3h 57m	0.04873	170.1	2.330x10^5
2	29	36,355	36,355	11.80	3,081	4h 11m	0.03988	207.8	6.402x10^5
3	30	12,618	66,710	11.76	5,673	4h 29m	0.03165	261.8	1.485x10^6
4	31	18,750	99,130	11.73	8,451	4h 57m	0.02210	375.0	3.170x10^6
5	32	35,085	185,500	11.78	15,750	5h 06m	0.01969	421.0	6.629x10^6
6	33	20,598	299,700	11.67	25,690	5h 24m	0.01563	530.4	1.362x10^7
Stringer E:									
1	34	14,369	14,369	11.48	1,252	3h 54m	0.04961	167.1	2.091x10^5
2	35	32,268	32,268	11.64	2,772	4h 09m	0.04092	202.5	5.615x10^5
3	36	11,036	58,350	11.79	4,949	4h 27m	0.03248	255.2	1.263x10^6
4	37	18,508	97,860	11.61	8,429	4h 42m	0.02679	309.4	2.607x10^6
5	38	29,421	155,600	11.83	13,150	5h 03m	0.02046	405.1	5.326x10^6
6	40	17,883	260,200	11.98	21,720	5h 21m	0.01624	510.3	1.087x10^7

Table 8. Run IV

Date: April 25, 1963
Conditions: Indium foils, cadmium-covered, at 1200 watts for 20 min
Reactor scram at 11:18 a.m.
Background count: 175 in 10 min or 18 cpm
Uranium standard: 47,891 in 2 min

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer A:									
1	4	11:45.5	346	5		69	-	69	51
2	5	12:13.5	544	3		181	-	181	163
3	6	12:31	1,359	2		680	-	680	662
4	7	12:43.5	7,024	2		3,512	1	3,513	3,495
5	8	12:56	43,505	2		21,752	47	21,799	21,781
6	9	1:13.5	49,223	2	With absorber #12	24,612	61	24,673	24,655
Stringer B:									
1	10	12:02.5	487	5		97	-	97	79
2	11	12:24	568	3		189	-	189	171
3	12	12:38.5	1,539	2		770	-	770	752
4	13	12:51	8,718	2		4,359	2	4,361	4,343
5	14	1:06	55,769	2		27,884	78	27,962	27,944
6	15	1:21	66,133	2	With absorber #12	33,066	109	33,175	33,157
Stringer C:									
1	16	12:08	308	5		62	-	62	44
2	18	12:27.5	1,764	3		588	-	588	570
3	19	12:41	1,657	2		828	-	828	810
4	20	12:53.5	8,662	2		4,331	2	4,333	4,315
5	22	1:08.5	56,468	2		28,234	80	28,314	28,296
		1:11	10,357	2	With absorber #12	5,178	3	5,181	5,163
6	24	1:23.5	68,599	2	With absorber #12	34,300	118	34,418	34,400
7	26	4:48	86,919	2	With absorber #13	43,460	189	43,649	43,634

Uranium standard: 47,982 in 2 min
Background: 146 in 10 min or 15 cpm

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer D:									
1	27	11:57	573	5		115	-	115	97
2	29	12:20.5	598	3		199	-	199	181
3	30	12:36	1,613	2		806	-	806	788
4	31	12:48.5	10,249	2		5,124	3	5,127	5,109
5	32	1:03.5	57,983	2		28,992	84	29,076	29,058
6	33	1:18.5	69,479	2	With absorber #12	34,740	121	34,861	34,843
Stringer E:									
1	34	11:51.5	926	5		185	-	185	167
2	35	12:17	487	3		162	-	162	144
3	36	12:33.5	1,485	2		742	-	742	724
4	37	12:46	6,765	2		3,382	1	3,383	3,365
5	38	1:01	50,409	2		25,204	64	25,268	25,250
6	40	1:16	48,690	2	With absorber #12	24,345	59	24,404	24,386

Table 8 (continued)

Absorber factor: for No. 12 = 5.307 (from Table 17)
for No. 13 = —

t_e = 20 min

$1 - e^{-\lambda t_e} = 0.22642$

F_c = 1.0096 (from Table 18)

F_p = 1.0172 (from Table 19b)

Position	Foil No.	Net cpm	True net cpm	Foil wt (mg)	$\frac{cpm}{mg}$	t_w	$e^{-\lambda t_w}$	F	A_{sat} $\frac{cpm}{mg}$
Stringer A:									
1	4	51	51	10.65	4.9	0h 30m	0.6804	6.67	32.4
2	5	163	163	11.05	14.8	0h 57m	0.4811	9.43	140
3	6	662	662	11.14	59.4	1h 14m	0.3868	11.73	697
4	7	3,495	3,495	10.83	323	1h 26.5m	0.3295	13.77	4,444
5	8	21,781	21,781	11.22	1,941	1h 39m	0.2886	15.72	30,510
6	9	24,655	130,800	10.78	12,140	1h 56.5m	0.2242	20.23	245,600
Stringer B:									
1	10	79	79	11.03	7.2	0h 47m	0.5470	8.29	61.1
2	11	171	191	10.99	15.6	1h 07.5m	0.4204	10.79	169
3	12	752	752	10.99	68.4	1h 21.5m	0.3513	12.91	883
4	13	4,343	4,343	10.80	402	1h 34m	0.2992	15.16	6,096
5	14	27,944	27,944	10.96	2,550	1h 49m	0.2468	18.38	46,860
6	15	33,157	176,000	10.66	16,500	2h 04m	0.2036	22.28	367,700
Stringer C:									
1	16	44	44	11.12	4.0	0h 52.5m	0.5097	8.90	35.3
2	18	570	570	10.57	54.0	1h 11m	0.4020	11.28	609
3	19	810	810	10.90	74.4	1h 24m	0.3402	13.33	992
4	20	4,315	4,315	10.76	401	1h 36.5m	0.2898	15.65	6,277
5	22	28,296	28,296	10.82	2,615	1h 51.5m	0.2390	18.98	49,630
6	24	5,163 34,400	182,600	10.66	17,120	2h 06.5m	0.1972	23.00	394,000
7	26	43,634							
Stringer D:									
1	27	97	97	11.54	8.4	0h 41.5m	0.5870	7.73	65.0
2	29	181	181	11.80	15.4	1h 04m	0.4398	10.31	159
3	30	788	788	11.76	67.1	1h 19m	0.3627	12.50	839
4	31	5,109	5,109	11.73	436	1h 31.5m	0.3090	14.68	6,394
5	32	29,058	29,058	11.78	2,467	1h 46.5m	0.2549	17.80	43,900
6	33	34,843	184,900	11.67	15,840	2h 01.5m	0.2102	21.57	341,800
Stringer E:									
1	34	167	167	11.48	14.6	0h 36m	0.6300	7.20	105
2	35	144	144	11.64	12.4	1h 0.5m	0.4600	9.86	122
3	36	724	724	11.79	61.5	1h 16.5m	0.3746	12.11	744
4	37	3,365	3,365	11.61	[illegible]90	1h 29m	0.3191	14.22	4,122
5	38	25,250	25,250	11.83	2,134	1h 44m	0.2632	17.23	36,790
6	40	24,386	129,400	11.98	10,800	1h 59m	0.2171	20.89	225,700

y

Table 9. Run V

Date: May 23, 1963
Conditions: Indium foils, bare, at 1800 watts for 10 min
Reactor scram at 10:55 a.m.
Background count: 156 in 10 min or 16 cpm
Uranium standard: 47,982 in 2 min

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer A:									
1	4	3:28.5	24,705	2		12,352	15	12,367	12,351
2	5	3:41	59,141	2		29,570	87	29,657	29,641
3	6	3:53.5	109,257	2		54,628	298	54,926	54,910
		3:56.5	20,349	2	With absorber #12	10,174	10	10,184	10,168
4	7	4:09.5	35,361	2	With absorber #12	17,680	31	17,711	17,695
5	8	4:22	63,185	2	With absorber #12	31,592	100	31,692	31,676
6	9	4:34.5	108,448	2	With absorber #12	54,224	294	54,518	54,502
Stringer B:									
1	10	3:36	26,812	2		13,406	18	13,424	13,408
2	11	3:48.5	62,897	2		31,448	99	31,547	31,531
3	12	4:04	21,621	2	With absorber #12	10,810	12	10,822	10,806
4	13	4:17	38,408	2	With absorber #12	19,204	37	19,241	19,225
5	14	4:29.5	69,750	2	With absorber #12	34,875	122	34,997	34,981
6	15	4:42.5	118,407	2	With absorber #12	59,204	350	59,554	59,538
Stringer C:									
1	16	3:38.5	26,655	2		13,328	18	13,346	13,330
2	19	3:51	60,767	2		30,384	92	30,476	30,460
3	20	4:06.5	21,246	2	With absorber #12	10,623	11	10,634	10,618
4	22	4:19.5	37,798	2	With absorber #12	18,899	36	18,935	18,919
5	24	4:32	67,130	2	With absorber #12	33,565	113	33,678	33,662
6	41	4:45	129,209	2	With absorber #12	64,604	417	65,021	65,005
7	42	5:07	43,660	2	With absorber #13	21,830	48	21,878	21,858

Uranium standard: 48,769 in 2 min
Background: 204 in 10 min or 20 cpm

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer D:									
1	26	3:33.5	28,461	2		14,230	20	14,250	14,234
2	27	3:46	65,468	2		32,734	107	32,841	32,825
3	29	4:01.5	23,515	2	With absorber #12	11,758	14	11,772	11,756
4	30	4:14.5	42,404	2	With absorber #12	21,202	45	21,247	21,231
5	31	4:27	75,699	2	With absorber #12	37,850	143	37,993	37,977
6	32	4:40	134,276	2	With absorber #12	67,138	451	67,589	67,573
Stringer E:									
1	33	3:31	24,608	2		12,304	15	12,319	12,303
2	34	3:43.5	58,328	2		29,164	85	29,249	29,233
3	35	3:59	20,671	2	With absorber #12	10,336	11	10,347	10,331
4	36	4:12	36,048	2	With absorber #12	18,024	32	18,056	18,040
5	37	4:24.5	62,473	2	With absorber #12	31,236	98	31,334	31,318
6	38	4:37.5	110,241	2	With absorber #12	55,120	304	55,424	55,408

Table 9 (continued)

Absorber factor: for No. 12 = 5.197 (from Table 17)
for No. 13 = —

t_e = 10 min

$1 - e^{-\lambda t_e} = 0.12046$

F_c = 1.0095 (from Table 18)

F_p = 0.97482 (from Table 19b)

Position	Foil No.	Net cpm	True net cpm	Foil wt (mg)	$\frac{cpm}{mg}$	t_w	$e^{-\lambda t_w}$	F	A_{sat} $\frac{cpm}{mg}$
Stringer A:									
1	4	12,351	12,351	10.65	1,160	4h 34.5m	0.02950	276.9	3.208×10^5
2	5	29,641	29,641	11.05	2,683	4h 47m	0.02512	325.1	8.722×10^5
3	6	54,910	54,910	11.14	4,929	4h 59.5m	0.02140	381.7	1.882×10^6
		10,168							
4	7	17,695	91,960	10.83	8,491	5h 15.5m	0.01743	468.8	3.980×10^6
5	8	31,676	164,600	11.22	14,670	5h 28m	0.01484	550.3	8.074×10^6
6	9	54,502	283,200	10.78	26,270	5h 40.5m	0.01264	646.1	1.698×10^7
Stringer B:									
1	10	13,408	13,408	11.03	1,216	4h 42m	0.02679	304.9	3.707×10^5
2	11	31,531	31,531	10.99	2,869	4h 54.5m	0.02282	358.0	1.027×10^6
3	12	10,806	56,160	10.99	5,110	5h 10m	0.01870	436.8	2.232×10^6
4	13	19,225	99,910	10.80	9,251	5h 23m	0.01583	516.1	4.775×10^6
5	14	34,981	181,800	10.96	16,590	5h 35.5m	0.01348	606.0	1.005×10^7
6	15	59,538	309,400	10.66	29,020	5h 48.5m	0.01141	716.0	2.078×10^7
Stringer C:									
1	16	13,330	13,330	11.12	1,199	4h 44.5m	0.02594	314.9	3.774×10^5
2	19	30,460	30,460	10.90	2,795	4h 57m	0.02210	369.7	1.033×10^6
3	20	10,618	55,180	10.76	5,128	5h 12.5m	0.01811	451.1	2.313×10^6
4	22	18,919	98,320	10.82	9,087	5h 25.5m	0.01533	533.0	4.843×10^6
5	24	33,662	174,900	10.66	16,410	5h 38m	0.01306	625.7	1.027×10^7
6	41	65,005	337,800	12.01	28,130	5h 51m	0.01105	739.3	2.080×10^7
7	42	21,858							
Stringer D:									
1	26	14,234	14,234	11.45	1,243	4h 39.5m	0.02766	295.3	3.671×10^5
2	27	32,825	32,825	11.54	2,845	4h 52m	0.02356	346.7	9.862×10^5
3	29	11,756	61,090	11.80	5,177	5h 07.5m	0.01931	423.0	2.190×10^6
4	30	21,231	110,300	11.76	9,382	5h 20.5m	0.01634	499.8	4.689×10^6
5	31	37,977	197,400	11.73	16,820	5h 33m	0.01392	586.8	9.873×10^6
6	32	67,573	351,200	11.78	29,810	5h 46m	0.01178	693.4	2.067×10^7
Stringer E:									
1	33	12,303	12,303	11.67	1,054	4h 37m	0.02857	286.0	3.015×10^5
2	34	29,333	29,333	11.48	2,546	4h 49.5m	0.02433	335.7	8.550×10^5
3	35	10,331	53,690	11.64	4,612	5h 05m	0.01994	409.7	1.889×10^6
4	36	18,040	93,750	11.79	7,952	5h 18m	0.01688	484.0	3.849×10^6
5	37	31,318	162,800	11.61	14,020	5h 30.5m	0.01437	568.3	7.967×10^6
6	38	55,408	287,900	11.83	24,340	5h 43.5m	0.01217	671.5	1.634×10^7

Table 10. Run VI

Date: May 27, 1963
Conditions: Indium foils, cadmium-covered, at 1800 watts for 20 min
Reactor scram at 10:31 a.m.
Background count: 166 in 10 min or 17 cpm
Uranium standard: 48,262 in 2 min

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer A:									
1	4	11:04	464	5		93	-	93	76
2	5	11:32	2,314	3		463	-	463	446
3	6	11:51.5	1,868	2		934	-	934	917
4	7	12:05	9,588	2		4,794	2	4,796	4,779
5	8	12:18.5	59,590	2		29,795	89	29,884	29,867
6	9	12:33.5	66,882	2	With absorber #12	33,441	112	33,553	33,536
Stringer B:									
1	10	11:20.5	650	5		130	-	130	113
2	11	11:44.5	836	3		279	-	279	262
3	12	11:54.5	2,187	2		1,094	-	1,094	1,077
4	13	12:12.5	11,593	2		5,796	3	5,799	5,782
5	14	12:26	77,225	2		38,612	149	38,761	38,744
6	15	12:41.5	90,311	2	With absorber #12	45,156	204	45,360	45,343
Stringer C:									
1	16	11:26	433	5		87	-	87	70
2	19	11:48	870	3		290	-	290	273
3	20	12:02.5	2,077	2		1,038	-	1,038	1,021
4	22	12:15	11,574	2		5,787	3	5,790	5,773
5	24	12:28.5	75,561	2		37,780	143	37,923	37,906
		12:31	14,259	2	With absorber #12	7,130	5	7,135	7,118
6	41	12:44	96,874	2	With absorber #12	48,437	235	48,672	48,655
7	44	5:07	53,151	2	With absorber #13	26,576	71	26,647	26,619

Uranium standard: 48,322 in 2 min
Background: 277 in 10 min or 28 cpm

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer D:									
1	26	11:15	1,212	5		242	-	242	225
2	27	11:41	783	3		261	-	261	244
3	29	12:00	2,074	2		1,037	-	1,037	1,020
4	30	12:10	15,041	2		7,520	6	7,526	7,509
5	31	12:23.5	80,390	2		40,195	162	40,357	40,340
6	32	12:39	97,100	2	With absorber #12	48,550	236	48,786	48,769
Stringer E:									
1	33	11:09.5	1,180	5		236	-	236	219
2	34	11:37.5	921	3		307	-	307	290
3	35	11:57	1,684	2		842	-	842	825
4	36	12:07.5	8,976	2		4,488	2	4,490	4,473
5	37	12:21	56,583	2		28,292	80	28,372	28,355
6	38	12:36.5	65,117	2	With absorber #12	32,558	106	32,664	32,647

Table 10 (continued)

Absorber factor: for No. 12 = 5.157 (from Table 17)
for No. 13 = --

t_o = 20 min

$1 - e^{-\lambda t_e} = 0.22642$

F_c = 1.0036 (from Table 18)

F_p = 1.0075 (from Table 19b)

Position	Foil No.	Net cpm	True net cpm	Foil wt (mg)	$\frac{cpm}{mg}$	t_w	$e^{-\lambda t_w}$	F	A_{sat} $\frac{cpm}{mg}$
Stringer A:									
1	4	76	76	10.65	7.2	0h 35.5m	0.6340	7.04	50.3
2	5	446	446	11.05	40.4	1h 03.5m	0.4426	10.09	407
3	6	917	917	11.14	82.4	1h 21.5m	0.3513	12.71	1,047
4	7	4,779	4,779	10.83	441	1h 35m	0.2954	15.12	6,672
5	8	29,867	29,867	11.22	2,662	1h 48.5m	0.2484	17.98	47,860
6	9	33,536	173,000	10.78	16,040	2h 03.5m	0.2049	21.80	349,700
Stringer B:									
1	10	113	113	11.03	10.3	0h 52m	0.5130	8.71	89.5
2	11	262	262	10.99	23.8	1h 15m	0.3819	11.69	279
3	12	1,077	1,077	10.99	98.0	1h 24.5m	0.3380	13.21	1,295
4	13	5,782	5,782	10.80	535	1h 42.5m	0.2683	16.65	8,913
5	14	38,744	38,744	10.96	3,535	1h 56m	0.2256	19.79	69,980
6	15	45,343	233,800	10.66	21,940	2h 11.5m	0.1849	24.15	529,800
Stringer C:									
1	16	70	70	11.12	6.3	0h 57.5m	0.4780	9.34	58.8
2	19	273	273	10.90	25.1	1h 18.5m	0.3651	12.23	307
3	20	1,021	1,021	10.76	95.0	1h 32.5m	0.3050	14.64	1,390
4	22	5,773	5,773	10.82	534	1h 45m	0.2598	17.19	9,172
5	24	37,906	37,906	10.66	3,556	1h 58.5m	0.2185	20.44	72,690
6	41	7,118 48,655	7,118 250,900	12.01	20,890	2h 14m	0.1791	24.94	521,100
7	44	26,619							
Stringer D:									
1	26	225	225	11.45	19.7	0h 46.5m	0.5505	8.11	160
2	27	244	244	11.54	21.2	1h 11.5m	0.3994	11.18	237
3	29	1,020	1,020	11.80	86.5	1h 30m	0.3150	14.18	1,226
4	30	7,509	7,509	11.76	639	1h 40m	0.2770	16.12	10,290
5	31	40,340	40,340	11.73	3,439	1h 53.5m	0.2330	19.17	65,930
6	32	48,769	251,500	11.78	21,350	2h 09m	0.1909	23.39	499,400
Stringer E:									
1	33	219	219	11.67	18.8	0h 41m	0.5908	7.56	142
2	34	290	290	11.48	25.3	1h 08m	0.4178	10.69	270
3	35	825	825	11.64	70.9	1h 27m	0.3273	13.64	967
4	36	4,473	4,473	11.79	379	1h 37.5m	0.2861	15.61	5,923
5	37	28,355	28,355	11.61	2,442	1h 51m	0.2406	18.56	45,340
6	38	32,647	168,400	11.83	14,230	2h 06.5m	0.1972	22.65	322,400

Table 11. Run VII

Date: April 9, 1963
Conditions: Gold foils, bare, at 600 watts for 20 min
Reactor scram at 11:01 a.m.
Background count: 146 in 10 min or 15 cpm
Uranium standard: 48,163 in 2 min

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer A:									
1	31	11:23	15,365	2		7,682	6	7,688	7,673
2	32	11:36.5	42,241	2		21,120	45	21,265	21,250
3	33	11:49.5	92,528	2		46,264	214	46,478	46,463
4	34	12:02	187,925	2		93,962	883	94,845	94,830
		12:04.5	33,893	2	With absorber #12	16,946	29	16,975	16,960
5	35	12:19.5	69,156	2	With absorber #12	34,578	120	34,698	34,683
6	36	12:32	140,454	2	With absorber #12	70,227	493	70,720	70,705
		12:34.5	40,310	2	With absorbers #12 and #13	20,155	41	20,196	20,181
Stringer B:									
1	37	11:31.5	18,275	2		9,138	8	9,146	9,131
2	38	11:44.5	49,037	2		24,518	60	24,578	24,563
3	39	11:57	105,827	2		52,914	280	53,194	53,179
4	40	12:14.5	39,985	2	With absorber #12	19,992	40	20,032	20,017
5	41	12:27	82,359	2	With absorber #12	41,180	170	41,350	41,335
6	42	12:44.5	49,798	2	With absorbers #12 and #13	24,899	62	24,961	24,946
Stringer C:									
1	43	11:34	18,359	2		9,180	8	9,188	9,173
2	44	11:47	49,710	2		24,855	62	24,917	24,902
3	45	11:59.5	108,829	2		54,414	296	54,710	54,695
4	46	12:17	40,420	2	With absorber #12	20,210	41	20,251	20,236
5	47	12:29.5	84,310	2	With absorber #12	42,155	177	42,332	42,317
6	48	12:47	51,913	2	With absorbers #12 and #13	25,956	67	26,023	26,008
7	34	3:31	94,363	2	With absorber #13	47,182	223	47,405	47,391

Uranium standard: 48,161 in 2 min
Background: 140 in 10 min or 14 cpm

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer D:									
1	49	11:29	17,490	2		8,745	8	8,753	8,738
2	50	11:42	47,975	2		23,988	58	24,046	24,031
3	51	11:54.5	105,603	2		52,802	279	53,081	53,066
4	52	12:12	39,878	2	With absorber #12	19,939	40	19,979	19,964
5	53	12:24.5	82,925	2	With absorber #12	41,462	172	41,634	41,619
6	54	12:42	49,958	2	With absorbers #12 and #13	24,979	62	25,041	25,026
Stringer E:									
1	55	11:26	15,493	2		7,746	6	7,752	7,737
2	56	11:39.5	42,634	2		21,317	45	21,362	21,347
3	57	11:52	90,341	2		45,170	204	45,374	45,359
4	58	12:09.5	33,337	2	With absorber #12	16,668	28	16,696	16,681
5	59	12:22	67,923	2	With absorber #12	33,962	115	34,077	34,062
6	60	12:39.5	39,764	2	With absorbers #12 and #13	19,882	40	19,922	19,907

Table 11 (continued)

Absorber factor: for No. 12 = 5.589 (from Table 17)
for No. 13 = 3.502

t_e = 20 min.　　　F_c = 1.0056

$1 - e^{-\lambda t_e}$ = 0.0035585　　　F_p = 1.0180

Position	Foil No.	Net cpm	True net cpm	Foil wt (mg)	$\frac{cpm}{mg}$	t_w	$e^{-\lambda t_w}$	F	A_{sat} $\frac{cpm}{mg}$
Stringer A:									
1	31	7,673	7,673	64.63	118.7	0h 23m	0.9959	288.9	3.430×10^4
2	32	21,250	21,250	64.75	328.2	0h 36.5m	0.9935	289.6	9.503×10^4
3	33	46,463	46,463	65.05	714.3	0h 49.5m	0.9912	290.2	2.073×10^5
4	34	94,830	94,830	63.38	1,496	1h 02m	0.9890	290.9	4.353×10^5
		16,960							
5	35	34,683	193,800	63.30	3,062	1h 19.5m	0.9859	291.8	8.935×10^5
6	36	70,705	395,200	63.57	6,216	1h 32m	0.9837	292.5	1.817×10^6
		20,181							
Stringer B:									
1	37	9,131	9,131	63.71	143.3	0h 31.5m	0.9944	289.3	4.147×10^4
2	38	24,563	24,563	63.21	388.6	0h 44.5m	0.9921	290.0	1.127×10^5
3	39	53,179	53,179	62.97	844.5	0h 57m	0.9899	290.6	2.454×10^5
4	40	20,017	111,900	63.02	1,775	1h 14.5m	0.9868	291.5	5.175×10^5
5	41	41,335	231,000	61.26	3,771	1h 27m	0.9846	292.2	1.102×10^6
6	42	24,946	488,200	61.64	7,921	1h 44.5m	0.9815	293.1	2.322×10^6
Stringer C:									
1	43	9,173	9,173	61.80	148.4	0h 34m	0.9940	289.4	4.296×10^4
2	44	24,902	24,902	61.98	401.8	0h 47m	0.9917	290.1	1.166×10^5
3	45	54,695	54,695	62.17	879.8	0h 59.5m	0.9895	290.8	2.558×10^5
4	46	20,236	113,100	62.05	1,823	1h 17m	0.9864	291.7	5.316×10^5
5	47	42,317	236,500	62.03	3,813	1h 29.5m	0.9842	292.3	1.115×10^6
6	48	26,008	509,000	62.02	8,208	1h 47m	0.9811	293.2	2.407×10^6
7	34	47,391							
Stringer D:									
1	49	8,738	8,738	62.05	140.8	0h 29m	0.9948	289.2	4.072×10^4
2	50	24,031	24,031	62.15	386.7	0h 42m	0.9925	289.9	1.121×10^5
3	51	53,066	53,066	62.15	853.8	0h 54.5m	0.9903	290.5	2.480×10^5
4	52	19,964	111,600	62.19	1,794	1h 12m	0.9872	291.4	5.228×10^5
5	53	41,619	232,600	62.16	3,742	1h 24.5m	0.9851	292.1	1.093×10^6
6	54	25,026	489,800	61.99	7,902	1h 42m	0.9820	293.0	2.315×10^6
Stringer E:									
1	55	7,737	7,737	64.86	119.3	0h 26m	0.9954	289.0	3.448×10^4
2	56	21,347	21,347	64.94	328.7	0h 39.5m	0.9930	289.7	9.524×10^4
3	57	45,359	45,359	62.34	727.6	0h 52m	0.9908	290.4	2.113×10^5
4	58	16,681	93,230	62.43	1,493	1h 09.5m	0.9877	291.3	4.350×10^5
5	59	34,062	190,400	62.33	3,054	1h 22m	0.9855	291.9	8.916×10^5
6	60	19,907	389,600	62.41	6,243	1h 39.5m	0.9824	292.8	1.828×10^6

Table 12. Run VIII

Date: April 4, 1963
Conditions: Gold foils, cadmium-covered, at 600 watts for 20 min
Reactor scram at 9:46 a.m.
Background count: 1476 in 5 min or 295 cpm
(Reactor was operating at 10 kw during counting.)
Uranium standard: 47,950 in 2 min

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer A:									
1	1	10:32	615	6		205	-	205	
2	2	10:48	720	2		360	-	360	
3	3	11:02	792	2		396	-	396	
4	4	11:16	1,032	2		516	-	516	
5	5	11:28.5	2,890	2		1,445	-	1,445	
6	6	11:41	16,637	2		8,318	7	8,325	
Stringer B:									
1	7	10:42.5	786	2		262	-	262	
2	8	10:56	747	2		374	-	374	
3	9	11:10.5	850	2		425	-	425	
4	10	11:23.5	1,200	2		600	-	600	
5	11	11:36	4,118	2		2,059	-	2,059	
6	12	11:48.5	25,571	2		12,786	16	12,802	
Stringer C:									
1	13	10:45	735	2		368	-	368	
2	14	10:59	781	2		390	-	390	
3	15	11:13	794	2		397	-	397	
4	16	11:26	1,211	2		606	-	606	
5	17	11:38.5	4,032	2		2,016	-	2,016	
6	18	11:51	26,975	2		13,488	18	13,506	
7	40	1:56	122,674	2	With absorber #13	61,337	376	61,713	61,689

Uranium standard: 47,931 in 2 min
Background: 244 in 10 min or 24 cpm

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer D:									
1	19	10:40	690	2		345	-	345	
2	20	10:53.5	794	2		397	-	397	
3	21	11:08	882	2		441	-	441	
4	22	11:21	1,118	2		559	-	559	
5	23	11:33.5	3,997	2		1,998	-	1,998	
6	24	11:46	25,273	2		12,636	16	12,652	
Stringer E:									
1	25	10:37.5	620	2		310	-	310	
2	26	10:50.5	729	2		364	-	364	
3	27	11:05	833	2		416	-	416	
4	28	11:18.5	1,036	2		518	-	518	
5	29	11:31	2,928	2		1,464	-	1,464	
6	30	11:43.5	16,087	2		8,044	6	8,050	

Table 12 (continued)

Absorber factor: for No. 12 = no absorber used
for No. 13 = --

t_e = 20 min

$1 - e^{-\lambda t_e} = 0.0035585$

F_c = 1.0102 (from Table 18)

F_p = 1.0495 (from Table 19b)

Position	Foil No.	Net cpm	True net cpm	Foil wt (mg)	$\frac{cpm}{mg}$	t_w	$e^{-\lambda t_w}$	F	A_{sat} $\frac{cpm}{mg}$
Stringer A:									
1	1		-	63.85	-	0h 49m	0.9913	300.5	-
2	2		65	65.40	1.0	1h 03m	0.9888	301.3	300
3	3		101	63.78	1.58	1h 17m	0.9864	302.0	477
4	4		221	63.99	3.45	1h 31m	0.9839	302.8	1,040
5	5		1,150	64.19	17.91	1h 43.5m	0.9817	303.5	5,436
6	6		8,030	63.55	126.4	1h 56m	0.9795	304.1	38,430
Stringer B:									
1	7		-	63.55	-	0h 57.5m	0.9898	301.0	-
2	8		79	63.84	1.23	1h 11m	0.9874	301.7	370
3	9		130	60.40	2.15	1h 25.5m	0.9849	302.5	650
4	10		305	63.20	4.82	1h 38.5m	0.9826	303.2	1,460
5	11		1,764	61.39	28.73	1h 51m	0.9804	303.9	8,730
6	12		12,507	61.49	203.4	2h 03.5m	0.9782	304.6	61,950
Stringer C:									
1	13		73	61.01	1.18	1h 00m	0.9894	301.1	360
2	14		95	61.32	1.55	1h 14m	0.9869	301.9	470
3	15		102	61.59	1.65	1h 28m	0.9844	302.6	500
4	16		311	61.76	5.02	1h 41m	0.9822	303.3	1,520
5	17		1,721	61.53	27.97	1h 53.5m	0.9800	304.0	8,502
6	18		13,211	61.56	214.6	2h 06m	0.9778	304.7	62,340
7	40	61,689							
Stringer D:									
1	19		50	65.60	0.76	0h 55m	0.9902	300.9	230
2	20		102	65.45	1.56	1h 08.5m	0.9879	301.6	470
3	21		146	62.85	2.32	1h 23m	0.9853	302.4	700
4	22		264	62.78	4.20	1h 36m	0.9830	303.1	1,270
5	23		1,703	62.71	27.16	1h 48.5m	0.9808	303.7	8,250
6	24		12,357	62.73	197.0	2h 01m	0.9787	304.4	59,970
Stringer E:									
1	25		15	62.57	0.24	0h 52.5m	0.9907	300.7	71
2	26		69	63.27	1.08	1h 05.5m	0.9884	301.4	320
3	27		121	62.80	1.93	1h 20m	0.9858	302.2	580
4	28		223	63.99	3.48	1h 33.5m	0.9835	302.9	1,050
5	29		1,169	64.09	18.24	1h 46m	0.9813	303.6	5,537
6	30		7,755	64.53	120.2	1h 58.5m	0.9791	304.3	36,570

Table 13. Run IX

Date: April 23, 1963
Conditions: Gold foils, bare, at 1200 watts for 20 min
Reactor scram at 11:28 a.m.
Background count: 150 in 10 min or 15 cpm
Uranium standard: 47,934 in 2 min

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer A:									
1	91	11:47	30,643	2		15,322	24	15,346	15,331
2	92	11:59.5	82,819	2		41,410	172	41,582	41,567
3	93	12:14.5	32,523	2	With absorber #12	16,262	26	16,288	16,273
4	94	12:27	67,122	2	With absorber #12	33,561	113	33,674	33,659
		12:29.5	19,105	2	With absorbers #12 and #13	9,552	9	9,561	9,546
5	95	12:42	39,099	2	With absorbers #12 and #13	19,550	38	19,588	19,573
6	96	12:54.5	79,903	2	With absorbers #12 and #13	39,952	160	40,112	40,097
Stringer B:									
1	97	11:54.5	36,158	2		18,079	33	18,112	18,097
2	98	12:09.5	17,393	2	With absorber #12	8,696	8	8,704	8,689
3	99	12:22	38,174	2	With absorber #12	19,087	36	19,123	19,108
4	100	12:37	22,696	2	With absorbers #12 and #13	11,348	13	11,361	11,346
5	101	12:49.5	47,980	2	With absorbers #12 and #13	23,990	58	24,048	24,033
6	102	1:02	99,508	2	With absorbers #12 and #13	49,754	248	50,002	49,987
Stringer C:									
1	103	11:57	35,713	2		17,856	32	17,888	17,873
2	104	12:12	18,055	2	With absorber #12	9,028	8	9,036	9,021
3	105	12:24.5	39,651	2	With absorber #12	19,826	39	19,865	19,850
4	106	12:39.5	23,392	2	With absorbers #12 and #13	11,696	14	11,710	11,695
5	107	12:52	49,919	2	With absorbers #12 and #13	24,960	62	25,022	25,007
6	108	1:04.5	105,516	2	With absorbers #12 and #13	52,758	278	53,036	53,021
7	38	5:43	51,403	2	With absorber #13	25,702	66	25,768	25,752

Uranium standard: 47,769 in 2 min
Background: 163 in 10 min or 16 cpm

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer D:									
1	109	11:52	35,698	2		17,849	32	17,881	17,866
2	110	12:07	17,532	2	With absorber #12	8,766	8	8,774	8,759
3	111	12:19.5	37,639	2	With absorber #12	18,820	35	18,855	18,840
4	112	12:34.5	22,787	2	With absorbers #12 and #13	11,394	13	11,407	11,392
5	113	12:47	47,157	2	With absorbers #12 and #13	23,578	56	23,634	23,619
6	114	12:59.5	99,512	2	With absorbers #12 and #13	49,756	248	50,004	49,989
Stringer E:									
1	115	11:49.5	30,144	2		15,072	23	15,095	15,080
2	116	12:02	83,513	2		41,756	174	41,930	41,915
		12:04.5	14,929	2	With absorber #12	7,464	6	7,470	7,455
3	117	12:17	31,907	2	With absorber #12	15,954	25	15,979	15,964
4	118	12:32	18,949	2	With absorbers #12 and #13	9,474	9	9,483	9,468
5	119	12:44.5	39,098	2	With absorbers #12 and #13	19,549	38	19,587	19,572
6	120	12:57	78,599	2	With absorbers #12 and #13	39,300	154	39,454	39,439

Table 13 (continued)

Absorber factor: for No. 12 = 5.620
for No. 13 = 3.524 (from Table 17)

t_e = 20 min

F_c = 1.0105 (from Table 18)

$1 - e^{-\lambda t_e} = 0.0035585$

F_p = 0.99491 (from Table 19b)

Position	Foil No.	Net cpm	True net cpm	Foil wt (mg)	$\frac{cpm}{mg}$	t_w	$e^{-\lambda t_w}$	F	A_{sat} $\frac{cpm}{mg}$
Stringer A:									
1	91	15,331	15,331	63.44	241.6	0h 20m	0.9964	283.5	6.851×10^{4}
2	92	41,567	41,567	62.80	661.9	0h 32.5m	0.9942	284.2	1.878×10^{5}
3	93	16,273	91,450	62.78	1,456	0h 47.5m	0.9916	284.9	4.150×10^{5}
4	94	33,659	189,200	62.71	3,016	1h 00m	0.9894	285.6	8.613×10^{5}
5	95	9,546 19,573	387,600	62.60	6,192	1h 15m	0.9867	286.3	1.773×10^{6}
6	96	40,097	794,100	62.48	12,710	1h 27.5m	0.9845	287.0	3.647×10^{6}
Stringer B:									
1	97	18,097	18,097	62.34	290.3	0h 27.5m	0.9951	283.9	8.241×10^{4}
2	98	8,689	48,830	62.32	783.6	0h 42.5m	0.9925	284.7	2.231×10^{5}
3	99	19,108	107,400	62.07	1,730	0h 55m	0.9902	285.3	4.936×10^{5}
4	100	11,346	224,700	62.17	3,614	1h 10m	0.9876	286.1	1.034×10^{6}
5	101	24,033	476,000	62.21	7,651	1h 22.5m	0.9854	286.7	2.194×10^{6}
6	102	49,987	990,000	60.89	16,260	1h 35m	0.9832	287.3	4.672×10^{6}
Stringer C:									
1	103	17,873	17,873	60.81	293.9	0h 30m	0.9947	284.0	8.348×10^{4}
2	104	9,021	50,700	64.34	787.9	0h 45m	0.9920	284.8	2.244×10^{5}
3	105	19,850	111,600	64.30	1,735	0h 57.5m	0.9898	285.4	4.952×10^{5}
4	106	11,695	231,600	64.20	3,608	1h 12.5m	0.9872	286.2	1.033×10^{6}
5	107	~~25,007~~	~~495,300~~	~~64.08~~	~~7,729~~	~~1h 25m~~	~~0.9850~~	~~286.8~~	~~2.217×10^{6}~~
6	108	53,021	1,050,000	64.19	16,360	1h 37.5m	0.9828	287.5	4.703×10^{6}
7	38	25,752							
Stringer D:									
1	109	17,866	17,866	62.00	288.2	0h 25m	0.9956	283.8	5.296×10^{4}
2	110	8,759	49,220	62.04	793.4	0h 40m	0.9929	284.5	2.258×10^{5}
3	111	18,840	105,900	62.01	1,707	0h 52.5m	0.9907	285.2	4.869×10^{5}
4	112	11,392	225,600	61.86	3,647	1h 07.5m	0.9880	285.9	1.043×10^{6}
5	113	23,619	467,800	61.47	7,610	1h 20m	0.9858	286.6	2.181×10^{6}
6	114	49,989	990,000	61.55	16,090	1h 32.5m	0.9836	287.2	4.620×10^{6}
Stringer E:									
1	115	15,080	15,080	61.65	244.6	0h 22.5m	0.9960	283.6	6.938×10^{4}
2	116	41,915	41,915	61.48	681.8	0h 35m	0.9938	284.3	1.938×10^{5}
3	117	7,455 15,964	89,720	61.61	1,456	0h 50m	0.9911	285.0	4.151×10^{5}
4	118	9,468	187,500	61.72	3,038	1h 05m	0.9885	285.8	8.684×10^{5}
5	119	19,572	387,600	61.53	6,300	1h 17.5m	0.9863	286.4	1.805×10^{6}
6	120	39,439	781,100	61.23	12,760	1h 30m	0.9841	287.1	3.662×10^{6}

Table 14. Run X

Date: April 22, 1963
Conditions: Gold foils, cadmium-covered, at 1200 watts for 20 min
Reactor scram at 3:30 p.m.
Background count: 144 in 10 min or 14 cpm
Uranium standard: 47,732 in 2 min

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer A:									
1	61	3:51	87	5		17	-	17	
2	62	4:22.5	118	5		24	-	24	
3	63	4:50	144	2		72	-	72	
4	64	5:02.5	617	2		308	-	308	
5	65	5:15	4,760	2		2,380	1	2,381	
6	66	5:27.5	33,631	2		16,816	28	16,844	
Stringer B:									
1	67	4:10	116	5		23	-	23	
2	68	4:39	146	5		29	-	29	
3	69	4:57.5	158	2		79	-	79	
4	70	5:10	896	2		448	-	448	
5	71	5:22.5	6,522	2		3,261	1	3,262	
6	72	5:35	51,637	2		25,818	67	25,885	
Stringer C:									
1	73	4:17	92	5		18	-	18	
2	74	4:44.5	203	5		41	-	41	
3	75	5:00	175	2		88	-	88	
4	76	5:12.5	896	2		448	-	448	
5	77	5:25	7,033	2		3,516	1	3,517	
6	78	5:37.5	55,051	2		27,526	76	27,602	
7	33	8:30	124,413	2	With absorber #13	62,206	387	62,593	62,576

Uranium standard: 48,213 in 2 min
Background: 169 in 10 min or 17 cpm

Stringer D:									
1	79	4:04	91	5		18	-	18	
2	80	4:33.5	144	5		29	-	29	
3	81	4:55	146	2		73	-	73	
4	82	5:07.5	892	2		446	-	446	
5	83	5:20	6,529	2		3,264	1	3,265	
6	84	5:32.5	51,466	2		25,733	66	25,799	
Stringer E:									
1	85	3:58	93	5		19	-	19	
2	86	4:28	111	5		22	-	22	
3	87	4:52.5	119	2		60	-	60	
4	88	5:05	601	2		300	-	300	
5	89	5:17.5	4,637	2		2,318	-	2,318	
6	90	5:30	32,475	2		16,238	26	16,264	

Table 14 (continued)

Absorber factor: for No. 12 = no absorber used
for No. 13 = no absorber used

t_e = 20 min

$1 - e^{-\lambda t_e}$ = 0.0035585

F_c = 1.0147 (from Table 18)

F_p = 1.0675 (from Table 19b)

Position	Foil No.	Net cpm	True net cpm	Foil wt (mg)	$\frac{cpm}{mg}$	t_w	$e^{-\lambda t_w}$	F	A_{sat} $\frac{cpm}{mg}$
Stringer A:									
1	61		3	62.59	0.05	0h 23.5m	0.9958	305.7	14
2	62		10	62.19	0.15	0h 55m	0.9902	307.4	45
3	63		58	61.89	0.93	1h 21m	0.9857	308.8	287
4	64		294	62.07	4.74	1h 33.5m	0.9835	309.5	992
5	65		2,367	64.04	36.95	1h 46m	0.9813	310.2	11,460
6	66		16,830	64.02	262.9	1h 58.5m	0.9791	310.9	81,730
Stringer B:									
1	67		9	63.85	0.14	0h 42.5m	0.9925	306.7	42
2	68		15	63.99	0.23	1h 11.5m	0.9873	308.3	71
3	69		65	64.04	1.01	1h 28.5m	0.9844	309.2	312
4	70		434	63.75	6.80	1h 41m	0.9822	309.9	2,108
5	71		3,248	63.76	50.94	1h 53.5m	0.9800	310.6	15,820
6	72		25,871	63.76	405.8	2h 06m	0.9778	311.3	126,320
Stringer C:									
1	73		4	63.62	0.06	0h 49.5m	0.9912	307.1	19
2	74		27	63.72	0.41	1h 17m	0.9864	308.6	127
3	75		74	63.49	1.15	1h 31m	0.9839	309.4	356
4	76		434	63.72	6.80	1h 43.5m	0.9817	310.1	2,110
5	77		3,503	60.44	57.96	1h 56m	0.9795	310.8	18,010
6	78		27,588	60.30	457.5	2h 08.5m	0.9774	311.5	142,500
7	33	62,576							
Stringer D:									
1	79		4	60.81	0.06	0h 36.5m	0.9935	306.4	19
2	80		15	60.78	0.24	1h 06m	0.9883	308.0	73
3	81		59	61.11	0.96	1h 26m	0.9848	309.1	296
4	82		432	62.82	6.87	1h 33.5m	0.9826	309.8	2,128
5	83		3,251	63.03	51.58	1h 51m	0.9804	310.5	16,020
6	84		25,785	62.96	409.5	2h 03.5m	0.9782	311.2	127,400
Stringer E:									
1	85		5	63.08	0.07	0h 30.5m	0.9946	306.1	20
2	86		7	63.41	0.12	1h 00.5m	0.9893	307.7	38
3	87		46	63.24	0.71	1h 23.5m	0.9852	309.0	220
4	88		286	63.26	4.52	1h 36m	0.9830	309.7	1,400
5	89		2,304	63.34	36.38	1h 48.5m	0.9808	310.4	11,290
6	90		16,250	63.51	255.9	2h 01m	0.9787	311.0	79,580

Table 15. Run XI

Date: May 9, 1963
Conditions: Gold foils, bare, at 1800 watts for 20 min
Reactor scram at 11:29 a.m.
Background count: 157 in 10 min or 16 cpm
Uranium standard: 48,580 in 2 min

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
Stringer A:									
1	1	1:30	45,585	2		22,792	52	22,844	22,828
2	2	1:47.5	22,402	2	With absorber #12	11,201	12	11,213	11,197
3	3	2:00	48,607	2	With absorber #12	24,304	59	24,363	24,347
4	4	2:15	28,440	2	With absorbers #12 and #13	14,220	20	14,240	14,224
5	5	2:27.5	58,475	2	With absorbers #12 and #13	29,238	85	29,323	29,307
6	6	2:45	118,147	2	With absorbers #12 and #13	59,074	349	59,423	59,407
Stringer B:									
1	7	1:32.5	53,105	2		26,552	70	26,622	26,606
2	8	1:55	26,112	2	With absorber #12	13,056	17	13,073	13,057
3	9	2:07.5	54,628	2	With absorber #12	27,314	75	27,389	27,373
4	10	2:22.5	33,741	2	With absorber #12 and #13	16,870	28	16,898	16,882
5	11	2:35	69,453	2	With absorbers #12 and #13	34,726	121	34,847	34,831
6	12	2:56.5	144,829	2	With absorbers #12 and #13	72,414	524	72,938	72,922
Stringer C:									
1	13	1:40	53,587	2		26,794	72	26,866	26,850
		1:45	9,712	2	With absorber #12	4,806	2	4,808	4,792
2	14	1:57.5	25,729	2	With absorber #12	12,864	16	12,880	12,864
3	15	2:10	56,300	2	With absorber #12	28,150	79	28,229	28,213
		2:12.5	16,160	2	With absorbers #12 and #13	8,080	6	8,086	8,070
4	16	2:25	33,827	2	With absorbers #12 and #13	16,914	29	16,943	16,927
5	17	2:42.5	70,998	2	With absorbers #12 and #13	35,499	126	35,625	35,609
6	18	2:59	150,579	2	With absorbers #12 and #13	75,290	567	75,857	75,841
7	41	5:19	104,817	2	With absorber #13	52,094	271	52,365	52,345
		Uranium standard: 48,807 in 2 min							
		Background: 199 in 10 min or 20 cpm							
Stringer D:									
1	19	1:37.5	54,086	2		27,043	73	27,116	27,100
2	20	1:52.5	26,301	2	With absorber #12	13,150	17	13,167	13,151
3	21	2:05	55,354	2	With absorber #12	27,677	77	27,754	27,738
4	22	2:20	33,620	2	With absorbers #12 and #13	16,810	28	16,838	16,822
5	23	2:32.5	70,374	2	With absorbers #12 and #13	35,187	128	35,315	35,299
6	24	2:54	146,808	2	With absorbers #12 and #13	73,404	539	73,943	73,927
Stringer E:									
1	25	1:35	45,672	2		22,836	52	22,888	22,872
2	26	1:50	21,770	2	With absorber #12	10,885	12	10,897	10,881
3	27	2:02.5	47,308	2	With absorber #12	23,654	56	23,710	23,694
4	28	2:17.5	27,644	2	With absorbers #12 and #13	13,822	19	13,841	13,825
5	29	2:30	57,509	2	With absorbers #12 and #13	28,754	83	28,837	28,821
6	30	2:47.5	115,197	2	With absorbers #12 and #13	57,598	332	57,930	57,914

Table 15 (continued)

Absorber factor: for No. 12 = 5.597; for No. 13 = 3.494 (from Table 17)

t_e = 20 min

$1 - e^{-\lambda t_e}$ = 0.0035585

F_c = 1.0496 (from Table 18)

F_p = 0.99701 (from Table 19b)

Position	Foil No.	Net cpm	True net cpm	Foil wt (mg)	$\frac{cpm}{mg}$	t_w	$e^{-\lambda t_w}$	F	A_{sat} $\frac{cpm}{mg}$
Stringer A:									
1	1	22,828	22,828	63.85	357.5	2h 02m	0.9785	300.5	1.075×10^5
2	2	11,197	62,680	65.40	958.4	2h 19.5m	0.9754	301.5	2.889×10^5
3	3	24,347	136,300	63.78	2,137	2h 32m	0.9733	302.2	6.456×10^5
4	4	14,224	278,200	63.99	4,348	2h 47m	0.9707	303.0	1.317×10^6
5	5	29,307	573,200	64.19	8,930	2h 59.5m	0.9685	303.6	2.711×10^6
6	6	59,407	1,162,000	63.55	18,280	3h 17m	0.9655	304.6	5.569×10^6
Stringer B:									
1	7	26,606	26,606	63.55	418.7	2h 04.5m	0.9781	300.7	1.259×10^5
2	8	13,057	73,090	63.84	1,145	2h 27m	0.9741	301.9	3.456×10^5
3	9	27,373	153,200	60.40	2,537	2h 39.5m	0.9720	302.6	7.675×10^5
4	10	16,882	330,200	63.20	5,225	2h 54.5m	0.9695	303.3	1.585×10^6
5	11	34,831	681,200	61.39	11,100	3h 07m	0.9672	304.0	3.374×10^6
6	12	72,922	1,426,000	61.49	23,190	3h 28.5m	0.9635	305.2	7.069×10^6
Stringer C:									
1	13	26,850	26,850	61.01	440.1	2h 12m	0.9767	301.1	1.325×10^5
		4,792							
2	14	12,864	72,010	61.32	1,174	2h 29.5m	0.9737	302.0	3.547×10^5
3	15	28,213	157,900	61.59	2,564	2h 42m	0.9715	302.7	7.761×10^5
		8,070							
4	16	16,927	331,000	61.76	5,360	2h 57m	0.9689	303.5	1.627×10^6
5	17	35,609	696,500	61.53	11,320	3h 14.5m	0.9659	304.5	3.446×10^6
6	18	75,841	1,483,300	61.56	24,100	3h 24m	0.9643	305.0	7.348×10^6
7	41	52,345							
Stringer D:									
1	19	27,100	27,100	65.60	413.1	2h 09.5m	0.9772	300.9	1.243×10^5
2	20	13,151	73,620	65.45	1,125	2h 24.5m	0.9746	301.8	3.394×10^5
3	21	27,738	155,300	62.85	2,470	2h 37m	0.9724	302.4	7.471×10^5
4	22	16,822	329,000	62.78	5,241	2h 52m	0.9698	303.2	1.589×10^6
5	23	35,299	691,400	62.71	11,020	3h 04.5m	0.9676	303.9	3.406×10^6
6	24	73,927	1,446,000	62.73	23,05C	3h 26m	0.9639	305.1	7.032×10^6
Stringer E:									
1	25	22,872	22,872	62.57	365.5	2h 07m	0.9776	300.8	1.100×10^5
2	26	10,881	60,900	63.27	962.6	2h 22m	0.9750	301.6	2.903×10^5
3	27	23,694	132,600	62.80	2,112	2h 34.5m	0.9728	302.3	6.384×10^5
4	28	13,825	270,400	63.99	4,226	2h 49.5m	0.9702	303.1	1.281×10^6
5	29	28,821	563,700	64.09	8,795	3h 02m	0.9681	303.8	2.672×10^6
6	30	57,914	1,133,000	64.53	17,550	3h 19.5m	0.9651	304.7	5.349×10^6

Table 16. Run XII

Position	Foil No.	Time at start of count	Total counts	Counting time (min)	Remarks	Counts per min	Dead time correction	Corrected cpm	Net cpm
		Date: May 23, 1963							
		Conditions: Gold foils, cadmium-covered, at 1800 watts for 20 min							
		Reactor scram at 11:53 a.m.							
		Background count: 202 in 10 min or 20 cpm							
		Uranium standard: 48,087 in 2 min							
Stringer A:									
1	61	1:06	137	5		27	-	27	
2	62	1:33.5	152	5		30	-	30	
3	63	2:01	414	5		83	-	83	
4	64	2:29	1,434	3		478	-	478	
5	65	2:46.5	6,780	2		3,390	1	3,391	
6	66	2:59	50,971	2		25,486	65	25,551	
Stringer B:									
1	67	1:17	122	5		24	-	24	
2	68	1:50	105	5		21	-	21	
3	69	2:18	557	5		111	-	111	
4	70	2:39.5	1,943	3		648	-	648	
5	71	2:54	9,974	2		4,987	2	4,989	
6	72	3:06.5	77,300	2		38,650	149	38,799	
Stringer C:									
1	73	1:28	187	5		37	-	37	
2	74	1:55.5	172	5		34	-	34	
3	75	2:23.5	604	5		121	-	121	
4	76	2:43	1,930	3		643	-	643	
5	77	2:56.5	9,968	2		4,984	2	4,986	
6	78	3:09	81,181	2		40,590	165	40,755	
7	44	5:10	144,616	2	With absorber #13	72,308	523	72,831	72,817
		Uranium standard: 48,697 in 2 min							
		Background: 142 in 10 min or 14 cpm							
Stringer D:									
1	79	1:22.5	108	5		22	-	22	
2	80	1:44.5	161	5		32	-	32	
3	81	2:12	619	5		124	-	124	
4	82	2:36	1,894	3		631	-	631	
5	83	2:51.5	9,949	2		4,974	2	4,976	
6	84	3:04	78,339	2		39,170	153	39,323	
Stringer E:									
1	85	1:11.5	121	5		24	-	24	
2	86	1:39	189	5		38	-	38	
3	87	2:06.5	453	5		91	-	91	
4	88	2:32.5	1,403	3		468	-	468	
5	89	2:49	6,503	2		3,252	1	3,253	
6	90	3:01.5	48,514	2		24,257	59	24,316	

Table 16 (continued)

Absorber factor: for No. 12 =
for No. 13 = no absorber used

t_e = 20 min

F_c = 1.0074 (from Table 18)

$1 - e^{-\lambda t_e}$ = 0.0035585

F_p = 1.0237 (from Table 19b)

Position	Foil No.	Net cpm	True net cpm	Foil wt (mg)	$\frac{cpm}{mg}$	t_w	$e^{-\lambda t_w}$	F	A_{sat} $\frac{cpm}{mg}$
Stringer A:									
1	61		7	62.59	0.12	1h 15.5m	0.9866	293.8	34
2	62		10	62.19	0.16	1h 43m	0.9818	295.2	48
3	63		63	61.89	1.01	2h 10.5m	0.9770	296.7	300
4	64		458	62.07	7.38	2h 37.5m	0.9723	298.1	2,200
5	65		3,371	64.04	52.64	2h 54.5m	0.9695	299.0	15,740
6	66		25,531	64.02	398.8	3h 07m	0.9672	299.7	119,500
Stringer B:									
1	67		4	63.85	0.07	1h 26.5m	0.9847	294.3	19
2	68		1	63.99	0.01	1h 59.5m	0.9789	296.1	4
3	69		91	64.04	1.42	2h 27.5m	0.9741	297.6	424
4	70		628	63.75	9.84	2h 48m	0.9705	298.6	2,940
5	71		4,969	63.76	77.94	3h 02m	0.9681	299.4	23,330
6	72		38,779	63.76	608.2	3h 14.5m	0.9659	300.0	182,500
Stringer C:									
1	73		17	63.62	0.27	1h 37.5m	0.9828	294.9	79
2	74		14	63.72	0.22	2h 05m	0.9780	296.4	66
3	75		101	63.49	1.58	2h 33m	0.9731	297.8	472
4	76		623	63.72	9.78	2h 51.5m	0.9699	298.8	2,920
5	77		4,966	60.44	82.17	3h 04.5m	0.9676	299.5	24,610
6	78		40,735	60.30	675.5	3h 17m	0.9655	300.2	202,800
7	44	72,817							
Stringer D:									
1	79		2	60.81	0.02	1h 32m	0.9837	294.6	7
2	80		12	60.78	0.20	1h 54m	0.9799	295.8	58
3	81		104	61.11	1.70	2h 21.5m	0.9751	297.2	404
4	82		611	62.82	9.73	2h 44.5m	0.9711	298.5	2,900
5	83		4,956	63.03	78.64	2h 59.5m	0.9685	299.3	23,530
6	84		39,303	62.96	624.2	3h 12m	0.9664	299.9	187,200
Stringer E:									
1	85		4	63.08	0.06	1h 21m	0.9857	294.0	19
2	86		18	63.41	0.28	1h 48.5m	0.9808	295.5	82
3	87		71	63.24	1.11	2h 16m	0.9761	296.9	331
4	88		448	63.26	7.07	2h 41m	0.9717	298.3	2,110
5	89		3,233	63.34	51.03	2h 57m	0.9689	299.1	15,260
6	90		24,296	63.51	382.5	3h 09.5m	0.9668	299.8	114,700

Table 17. Computation of absorber factors

Run	Absorber No.	Foil No.	Activity without absorber	Activity with absorber	t	$e^{-\lambda t}$	Absorber factor (relative)
I	12	16	32,820	6,043	3m	0.9622	5.226
II	12	7	75,593	12,853	9m	0.8909	5.240
III	12	18	32,493	5,914	3m	0.9622	5.287
	13	14	32,378	11,323	3m	0.9622	2.752
IV	12	22	28,296	5,163	2.5m	0.9684	5.307
V	12	6	54,910	10,168	3m	0.9622	5.197
VI	12	24	37,906	7,118	2.5m	0.9684	5.157
VII	12	35	94,830	16,960	2.5m	0.9996	5.589
	13	36	70,705	20,181	2.5m	0.9996	3.502
VIII	No absorber used						
IX	12	116	41,915	7,455	2.5m	0.9996	5.620
	13	94	33,659	9,546	2.5m	0.9996	3.524
X	No absorber used						
XI	12	13	26,850	4,792	5m	0.9991	5.597
	13	15	28.213	8,070	2.5m	0.9996	3.494
XII	No absorber used						

Table 18. Computation of counter factors (F_c)

Run	Counts in 2 min.	Gross counts per min.	Dead time correction	Back-ground	Net counts per min.	Factor F_c
I	48,433	24,216	59	15	24,260	1.0000
II	48,523	24,262	59	16	24,305	0.99821
III	47,979	23,990	58	18	24,030	1.0096
IV	47,981	23,990	58	18	24,030	1.0096
V	47,982	23,991	58	16	24,033	1.0095
VI	48,262	24,131	58	17	24,172	1.0036
VII	48,163	24,082	58	15	24,125	1.0056
VIII	47,950	23,975	58	17	24,016	1.0102
IX	47,934	23,967	57	15	24,009	1.0105
X	47,732	23,866	57	14	23,909	1.0147
XI	48,580	24,290	59	16	24,333	0.99701
XII	48,087	24,044	58	20	24,082	1.0074

Table 19a. Computation of counter factors for power factor calculation

Run	Counts in 2 min.	Gross count per min.	Dead time correction	Background	Net counts per min.	Factor F_c
I	48,690	24,345	59	16	24,388	0.99475
II	48,407	24,204	59	18	24,245	1.0007
III	48,663	24,332	59	19	24,372	0.99542
IV	47,982	23,991	58	15	24,034	1.0094
V	48,769	24,384	60	20	24,424	0.99332
VI	48,322	24,161	58	28	24,191	1.0028
VII	48,161	24,080	58	14	24,124	1.0056
VIII	47,931	23,966	57	24	23,999	1.0109
IX	47,769	23,884	57	16	23,925	1.0140
X	48,213	24,106	58	17	24,147	1.0047
XI	48,807	24,404	60	20	24,444	0.99253
XII	48,697	24,348	59	14	24,393	0.99454

Table 19b. Computation of power factor (F_p)

Run	Foil No.	Foil wt (mg)	Net counts per min	$\frac{cpm}{mg}$	t_e	t'_w	t_c	t_w to middle of t_c	$1-e^{-\lambda t_e}$	$e^{-\lambda t_w}$	$(1-e^{-\lambda t_e})$x $(e^{-\lambda t_w})$	A_{sat} (cpm)	F'_c	Corrected A_{sat} (cpm)	Power Factors P_F
I	32	11.78	73,556	6,244	20m	4h 0m	2m	4h 01m	0.22642	0.045344	0.010267	6.082x10^5	0.99475	6.050x10^5	1.0000
II	34	11.48	75,326	6,541	20m	3h 54m	2m	3h 55m	0.22642	0.048974	0.011089	5.917x10^5	1.0007	5.921x10^5	1.0217
III	26	11.45	23,605	2,061	10m	5h 32m	2m	5h 33m	0.12046	0.013921	0.0016769	1.229x10^6	0.99542	1.224x10^6	0.98879
IV	26	11.45	43,634	3,811	20m	5h 30m	2m	5h 31m	0.22642	0.014283	0.0032338	1.178x10^6	1.0094	1.190x10^6	1.0172
V	42	11.62	21,858	1,881	10m	6h 12m	2m	6h 13m	0.12046	0.0083305	0.0010035	1.874x10^6	0.99332	1.862x10^6	0.97482
VI	44	10.69	26,619	2,490	20m	6h 36m	2m	6h 37m	0.22642	0.0061218	0.0013861	1.796x10^6	1.0028	1.802x10^6	1.0075
VII	34	11.48	47,391	4,128	20m	4h 30m	2m	4h 31m	0.22642	0.030852	0.0069853	5.910x10^5	1.0056	5.943x10^5	1.0180
VIII	40	11.98	61,689	5,149	20m	4h 10m	2m	4h 11m	0.22642	0.039882	0.0090298	5.703x10^5	1.0109	5.765x10^5	1.0495
IX	38	11.83	25,752	2,177	20m	6h 15m	2m	6h 16m	0.22642	0.0080158	0.0018149	1.199x10^6	1.0140	1.216x10^6	0.99491
X	33	11.67	62,576	5,362	20m	5h 0m	2m	5h 01m	0.22642	0.020992	0.0047528	1.128x10^6	1.0047	1.133x10^6	1.0675
XI	41	12.01	52,345	4,358	20m	5h 50m	2m	5h 51m	0.22642	0.011049	0.0025016	1.742x10^6	0.99253	1.729x10^6	1.0496
XII	44	10.69	72,817	6,811	20m	5h 17m	2m	5h 18m	0.22642	0.016876	0.0038210	1.783x10^6	0.99454	1.773x10^6	1.0237